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**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
2001 RECEIVING WATER MONITORING REPORT
HAYNES AND AES ALAMITOS L.L.C. GENERATING STATIONS
LOS ANGELES COUNTY, CALIFORNIA**

2001 Survey

Prepared for:

**Los Angeles Department of Water and Power
and AES Alamitos L.L.C.**

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EXECUTIVE SUMMARY

The 2001 National Pollutant Discharge Elimination System (NPDES) marine monitoring program for the Haynes and AES Alamitos L.L.C. generating stations was conducted in accordance with specifications set forth by the California Regional Water Quality Control Board, Los Angeles Region (LARWQCB) in NPDES Permit Nos. CA0000353 and CA0001139, respectively. The 2001 studies included physical and chemical monitoring of the receiving waters and underlying sediments, and biological monitoring of benthic infauna, fish and macroinvertebrate assemblages, and mussels. Results of the 2001 surveys were compared among stations and with previous studies to determine if the beneficial uses of the receiving waters continue to be protected.

The Haynes Generating Station is owned and operated by the Los Angeles Department of Water and Power (LADWP). The AES Alamitos L.L.C. generating station, formerly called the Alamitos Generating Station, is a subsidiary of the AES Corporation.

WATER COLUMN MONITORING

In 2001, elevated water temperatures extended from the San Gabriel River into the shallow nearshore waters of San Pedro Bay as a layer of warm surface water. In winter, warmer waters were detected in the river and extending to Stations RW1 through RW5. During summer, the warm surface waters were present in the river, at the mouth of the river, and at Station RW4. During both the winter and summer surveys, dissolved oxygen concentrations and pH values were slightly lower at the three river stations than at offshore stations. During the winter survey, red tide was present at some of the inshore and offshore stations, resulting in somewhat higher DO and pH values at stations affected by the plankton bloom. Freshwater influence upriver of the generating stations resulted in lower pH values. The combined effects of decomposition on the bottom and a plankton bloom in the surface layers accounted for a wide fluctuation in DO concentrations from surface to bottom at Station RW10, which is typical at that station (MBC unpubl. data 1990-2000). All measured water quality parameters in 2001 were within the range of values previously recorded in the study area.

SEDIMENT MONITORING

Sediment Grain Size

In 2001, sediments in the offshore study area consisted primarily of sand, with an average mean grain size in the very fine sand category. Sediments at Stations B1, B2, B3, and B4 were fairly similar, while those at Station B6 were somewhat coarser, and at Stations B5 and B9 somewhat finer. Sediments at Station B7, at a depth of 40 ft and upcoast of the river, were finer than those elsewhere, probably because of the Long Beach Breakwater which offers some protection from swells. Sediments at Station B8 were coarser probably because it is not sheltered from the prevailing swells.

Samples were also taken in the San Gabriel River. Sediments at the three river stations (Stations RW10, RW11, and RW12) were composed mostly of sand, with an average mean grain size in the medium sand category. Sediments became increasingly finer with distance upstream with mean grain size in the very fine sand category at Station RW10 (further upstream).

Sediments were similar to those analyzed in previous surveys. The spatial and temporal variability in sediment characteristics in the study area reflects the non-uniform nature of the shallow subtidal marine environment, especially where obstructions, such as breakwaters, complicate the

movement of water and sediment. Results of the 2001 survey indicated that there were no effects from the generating stations on the sediments in or offshore of the San Gabriel River.

Sediment Chemistry

In 2001, highest metal concentrations generally were detected at Station B7, offshore and upcoast of the mouth of the San Gabriel River. These higher concentrations corresponded with finer sediments at that station, while lower concentrations generally correlated with less fine sediments as noted at Station B2. Sediments at Station B7 have often been finer than sediments at other offshore stations. In the river, finer sediments again correlated with higher metal concentrations and coarser sediments with lower metal concentrations resulting in generally greater concentrations down river. The Long Beach Breakwater probably accounts for the higher concentrations of metals noted at offshore Station B7 as it reduces effects from swells and currents increasing sediment deposition; sediment moving down river and its redeposition probably accounts for the finer sediments noted towards the entrance. In general, metal concentrations in the river were intermediate to the values seen between other stations. All sediment metal concentrations were within levels previously recorded in the study area and are not likely to affect marine life in the local area. The distribution of metals in the sediments of the study area does not appear to be related to the generating stations' discharges.

MUSSEL BIOACCUMULATION

Analysis of chromium, copper, nickel, and zinc metal levels in mussels collected in the San Gabriel River downstream of the Haynes and AES Alamitos L.L.C. generating stations in 2001 indicated that bioaccumulation of metals, with the exception of zinc, was not appreciable.

Although zinc levels were elevated above the biological Effects Range Low (ERL) level, they were similar to reference station results and well within the range noted in the California Mussel Watch program. Metal levels were not elevated in comparison to those found at other locations in the Southern California Bight.

BIOLOGICAL MONITORING

Benthic Infauna

The infaunal communities in the San Gabriel River and offshore of the river mouth in 2001 were dominated by small annelid worms and arthropod crustaceans typical of protected nearshore habitats in the Southern California Bight, and were similar to those previously seen in the study area. The polychaete worms *Owenia collaris* and *Mediomastus acutus* were the most abundant species in the offshore area. Two other polychaetes, *Mediomastus* spp. and *Apoprionospio pygmaea*, and two arthropods, the cumacean *Diastylopsis tenuis* and the amphipod *Amphideutopus oculatus*, were also very abundant. In the river, three arthropods *Monocorophium acherusicum*, *Ericthonius brasiliensis*, and *Grandidierella japonica*, and the annelid *Streblospio benedicti* dominated with over 82% of the total abundance. Overall, density of organisms averaged 7,558 individuals/m² offshore and 187,000 individuals/m² in the river. Diversity was low in the river because of the great abundance of a few opportunistic species. Offshore, community parameters were similar among stations, with species richness and diversity increasing with depth. Abundance was greater than average in the nearshore with overwhelming dominance by *Owenia* resulting in low species diversity at Station B2. Community composition appeared to be related to sediment characteristics as influenced by depth and protection from wave action. No effects of the generating stations' discharges on the benthic infaunal community in the river or in the offshore study area were apparent.

Fish and Macroinvertebrates

Trawls

The fish assemblage in 2001 was similar to that in previous surveys conducted since 1972. The overall catch was dominated by white croaker, speckled sanddab, and queenfish. White croaker and California halibut dominated the biomass during both surveys. A total of 866 individuals representing 27 species was collected. The abundance and number of species were lower than most previous surveys. This is most likely due to the patchy distribution and schooling nature of these species. The basic community structure was unchanged, with eight of the most abundant in all past surveys present in the top ten in abundance in 2001. More species and individuals were collected in winter. During the 2001 surveys there was a greater abundance at the downcoast and river mouth stations, but distributional patterns have shown no consistency through the years. Blackspotted bay shrimp, tuberculate pear crab, and spiny sand star were the most abundant macroinvertebrates and were taken at most stations during both surveys. They were also the most abundant species in the 1999 and 2000 surveys.

Impingement

Haynes. Fish impingement surveys during 16 heat treatments at Haynes Generating Station resulted in the take of 11 species of fish and 242 individuals for a total of 15 fish per heat treatment. The species seen were typical of the bay environment; the low number of individuals taken indicates that Haynes Generating Station is having a negligible effect on the fish populations of Alamitos Bay.

Alamitos. Fish impingement surveys during four heat treatments at AES Alamitos L.L.C. generating station resulted in the take of 15 species of fish and 134 individuals for a total of 34 fish per heat treatment. The species seen were typical of the bay environment; the low number of individuals taken indicates that AES Alamitos L.L.C. generating station is having a negligible effect on the fish populations of Alamitos Bay.

CONCLUSIONS

The overall results of the 2001 NPDES monitoring program indicated that operation of the Haynes and AES Alamitos L.L.C. generating stations had no detectable adverse effects on the beneficial uses of the receiving waters.

INTRODUCTION

This report presents and discusses the results of the 2001 receiving water monitoring studies conducted for the Haynes and AES Alamitos L.L.C. generating stations. The 2001 monitoring program was conducted in accordance with specifications set forth in National Pollutant Discharge Elimination System (NPDES) Monitoring and Reporting Program No. 2769 (Permit No. CA0000353) issued for the Haynes Generating Station by the California Regional Water Quality Control Board, Los Angeles Region (LARWQCB) on 29 June 2000 and NPDES Monitoring and Reporting Program No. 6113 (Permit No. CA 0001139) issued for the AES Alamitos L.L.C. generating station by the LARWQCB on 29 June 2000 (Appendix A). Results of the 2001 surveys were compared among stations and with past physical oceanographic and biological studies to determine what effects, if any, the generating station discharge is having on the marine environment, and if the beneficial uses of the receiving waters are being protected. Sampling included physical and chemical monitoring of the receiving waters and sediments, mussel bioaccumulation, and biological monitoring of infaunal and fish and macroinvertebrate assemblages.

The Haynes Generating Station is owned and operated by the Los Angeles Department of Water and Power (LADWP). The AES Alamitos L.L.C. generating station, formerly called the Alamitos Generating Station, is a subsidiary of the AES Corporation.

DESCRIPTION OF THE GENERATING STATIONS

The Haynes and AES Alamitos L.L.C. generating stations are located on opposite sides of the San Gabriel River Flood Control Channel. This channel is used by both generating stations to return thermal effluent from the once-through seawater condenser cooling systems to San Pedro Bay.

LADWP's Haynes Generating Station contains six steam electric generating units: four with a rated capacity of 230 megawatts (Mw) each and two with a rated capacity of 330 Mw each. Steam is supplied to each generating unit from a separate boiler which is fired by natural gas. The total rating of the plant is 1,580 Mw; however, the plant operated at approximately 28% of capacity from 1 October 2000 to 30 September 2001 (Mofidi 2001, pers. comm.).

Ocean water for cooling the Haynes plant is conveyed to the station from the northwest corner of Long Beach Marina through conduits and earthen channels. After passing through the condensers, the heated effluent is discharged via sluiceways to the San Gabriel River at three points approximately 3 kilometers (km) upstream of the river mouth. During the winter sampling period, 16 March 2001, Haynes Generating Station ran eight of 12 circulator pumps and discharged approximately 644 million gallons per day (mgd) of cooling water. Ten of 12 pumps ran during summer sampling, 18 September 2001, discharging approximately 711 mgd of cooling water. Intake temperature during winter was 15.6°C and discharge temperature differentials at the three discharges were: 13.1°C at Units 1 & 2 (001) and Units 3 & 4 (002); and 9.4°C at Units 5 & 6 (003). Intake temperature during summer was 19.4°C and discharge temperature differentials at the three discharges were: 7.3°C at Units 1 & 2 and 8.9°C at Units 5 & 6; intake and discharge temperatures remained the same at Units 3 & 4 (Mofidi 2001, pers. comm.).

AES Alamitos L.L.C. generating station consists of six steam-electric generating units: two rated at 175 Mw each, two rated at 320 Mw each, and two rated at 480 Mw each. In addition, there is a gas turbine electric generating unit which is rated at 147 Mw. The total capacity of the plant is 2,097 Mw; however, the plant operated at approximately 49% of capacity from 1 October 2000 to 30 September 2001 (Maghy 2001, pers. comm.).

Ocean water for cooling purposes is supplied to AES Alamitos L.L.C. generating station via canals off Los Cerritos Channel, which is connected to San Pedro Bay through the Long Beach Marina-Alamitos Bay complex. After passing through the plant's steam condenser, the heated water is discharged via sluiceways to the San Gabriel River at three points approximately 3.2 km upstream of the river mouth. The generating station ran 5 of 12 circulator pumps and discharged approximately 726 mgd of cooling water during winter sampling, 16 March 2001. Intake and discharge temperatures at Units 1 & 2 during winter were both 16.7°C. Discharge temperature at Units 5 & 6 was 33.3°C with a discharge differential temperature of 16.6°C. Units 3 & 4 were not in operation during winter sampling. Ten of 12 pumps ran during summer sampling, 18 September 2000, discharging approximately 1,167 mgd of cooling water. Intake temperature was 19.4°C and discharge temperature differentials during summer sampling at the three discharges were: Units 1 & 2, 12.8°C; Units 3 & 4, 12.8°C, and Units 5 & 6, 13.9°C (Maghy 2001, pers. comm.).

DESCRIPTION OF THE STUDY AREA

Location

The study area is located in coastal southern California, near the southeastern boundary of Los Angeles county (Figure 1) and includes sampling stations in the San Gabriel River and in San Pedro Bay.

The physiography, climatology, and hydrography of the southern California coastal region all contribute to the character of the study area. The effects of thermal discharges into coastal waters are influenced by complex interactions of oceanographic and meteorological elements which have

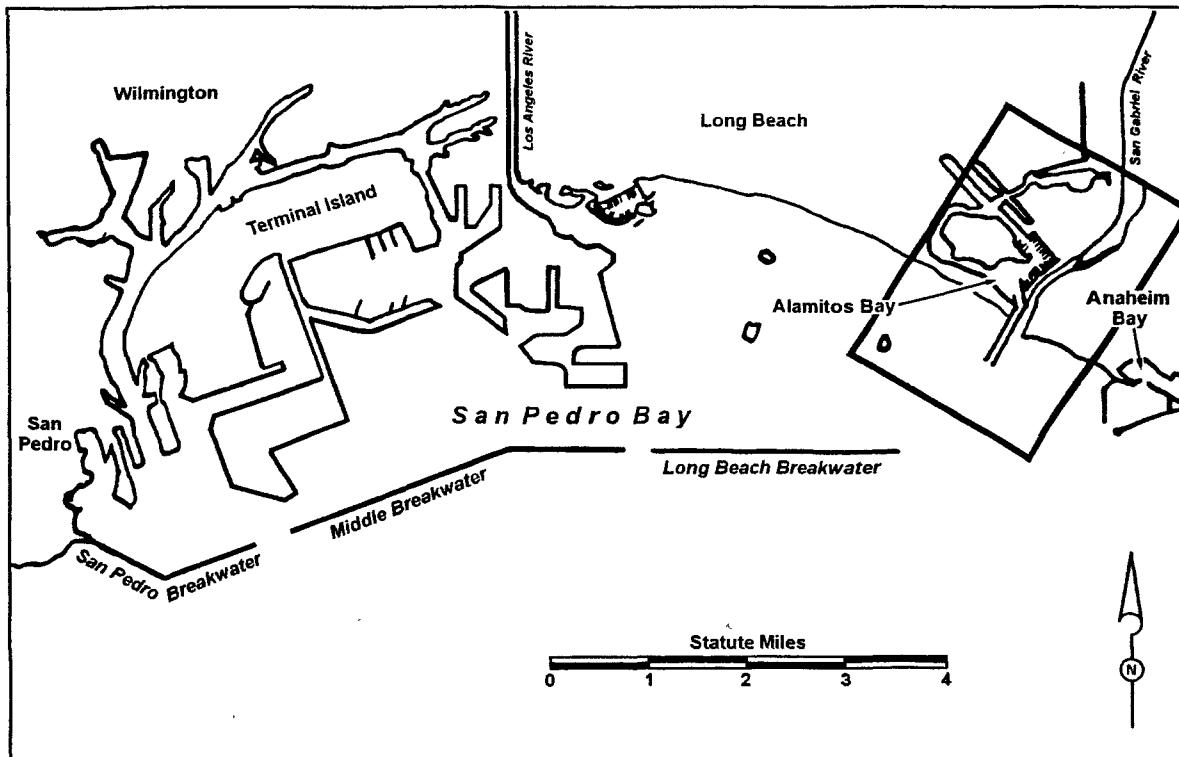


Figure 1. Location of the study area. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

short- and long-period cyclical variations as well as non-periodic trends. Winds, tides, and currents are particularly important since they have the greatest effect on the fate of thermal plumes.

Physiography

The general orientation of the coastline between Point Conception and the Mexican border is from northwest to southeast. The continental margin has been slowly emerging over geological time, resulting in a predominantly cliffted coastline, broken by coastal plains in the Oxnard-Ventura, Los Angeles, and San Diego areas.

Drainage of most of the coastal region is via many short streams which normally flow **only** during rain storms. However, only a small part of the storm drainage ever reaches the ocean; **most** is impounded by dams and diverted for other uses.

The San Gabriel River is a major flood control channel which is maintained by the Los Angeles County Flood Control District. The Army Corps of Engineers completed the concrete lining of the channel in May 1964 to a designed maximum flow of approximately 13 billion gallons per day. Coyote Creek is an important but intermittent feeder to the San Gabriel River, approximately 6.4 km upstream from the river mouth.

The San Gabriel River empties into the eastern end of San Pedro Bay, between Alamitos Bay to the west and Anaheim Bay to the east. The seafloor in the area is a mixture of silt and fine sands, and slopes gently outward from the river mouth. Tidal influence extends upriver about 5 km from the river mouth (or about 2 km upstream from the generating stations).

Rainfall and subsequent runoff into the San Gabriel River and adjacent portions of San Pedro Bay exert temporary but profound effects on the physical and chemical environments. Alterations of salinity, pH, dissolved oxygen, water clarity, and sediment deposition can, in turn, affect resident marine organisms.

The waters of Alamitos Bay are isolated from open coast circulation; water exchange depends on tidal flow through the harbor entrance. The removal of large volumes of water for plant cooling purposes increases the influx of ocean water into Alamitos Bay. The bay itself is unaffected by the thermal discharge since the flow from the San Gabriel River generally moves downcoast, away from the bay. Solar heating and limited mixing in the water column may cause water temperatures in Alamitos Bay to exceed ambient levels along the open coast.

Currents and wave surge in San Pedro Bay are reduced and thus do not enhance dispersion of the discharged thermal effluent. However, the net direction of flow at the mouth of the San Gabriel River is downcoast where incoming waves and longshore currents are not inhibited by breakwaters (EQA/MBC 1973).

Climate

Southern California lies in a climatic regime broadly defined as Mediterranean, which is characterized by short, mild winters and warm, dry summers. Long-term annual precipitation near the coast averages about 46 centimeters (cm), 90% of which occurs between November and April. During summer, sea breezes caused by differential heating between land and sea, combine with the prevailing winds that blow out of the northwest to produce strong onshore winds. They typically start around noon and may continue through late afternoon, with speeds reaching 40 km per hour. In late fall and winter, a reverse pressure system frequently develops, causing coastal offshore winds from the southeast from November through February, typically between 1300 to 2000 hours (hr). Monthly mean air temperatures along the coast range from 8.3°C in winter to 20.6°C in summer, with the minimum dropping slightly below freezing and maximum reaching above 37°C.

Currents

Water in the northern Pacific Ocean is driven eastward by prevailing westerly winds until it impinges on the western coast of North America where it divides to flow both north and south. The southern component is the California Current, a diffuse and meandering water mass which generally flows to the southeast. No fixed western boundary to this current is defined, but more than 90% of the bulk water transport is within 725 km of the California coast.

South of Point Conception the California Current diverges and one branch turns northward and flows inshore of the Channel Islands as the Southern California Countercurrent. Surface speed in the countercurrent ranges from 5 to 10 cm/second (cm/s). The general flow is complicated by small eddies around the Channel Islands and fluctuates seasonally, being well developed in summer and autumn, and weak or even absent in winter and spring. Generalized surface water circulation off southern California is shown in Figure 2. Currents near the coast are strongly influenced by a combination of wind, tide, and topography. When wind-driven currents are superimposed on the tidal motion, a strong diurnal component is usually apparent. Therefore, short-term observations of currents near the coast may often vary considerably in both direction and speed.

Tides

Tides along the California coast are mixed semi-diurnal, with two unequal highs and two unequal lows during each 25-hr period. In the eastern North Pacific Ocean, the tide wave rotates in a counterclockwise direction. As a result, flood tide currents flow upcoast and ebb tide currents flow downcoast. Tide heights in back areas of the San Gabriel River lag approximately two hours behind those predicted for the coastal area.

Upwelling

The predominantly northwesterly winds along the California coast are responsible for large scale upwelling. From about February to October these winds induce offshore movement of surface water, which is replaced by the upwelling of deeper ocean waters near the coast. The upwelled water is colder, more saline, lower in oxygen, and higher in nutrient concentrations than surface waters. Thus, upwelling not only alters the physical properties of the surface waters, but also affects biological productivity.

RECEIVING WATER CHARACTERISTICS

Water quality near the Haynes and AES Alamitos L.L.C. generating stations is affected by hydrology, currents, storm water runoff, industrial discharges, and ship traffic. In addition, climatological parameters such as solar radiation, humidity, and wind influence the condition of the receiving water.

The capacity of the ocean to absorb thermal discharges depends largely on its ability to dilute and disperse the heated water. The extent to which these functions are accomplished depends on the quantity and temperature of the thermal input relative to normal ocean temperature, as well as local currents and tides. The following discussion focuses on the natural ocean temperatures

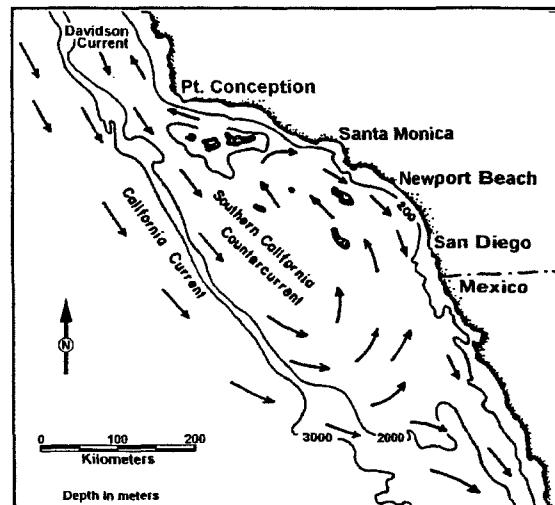


Figure 2. Surface circulation in the Southern California Bight (from Jones 1971). Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

along the southern California coast and in San Pedro Bay, and also addresses other physical and chemical oceanographic factors which may influence the local marine biota.

Temperature

Natural surface water temperatures in southern California may be expected to vary diurnally 1 to 2°C in summer and 0.3 to 1°C in winter (EQA/MBC 1973). Weak winds, clear skies, and warm air temperatures contribute to rapid daytime warming of the sea surface. Conversely, overcast skies, moderate air temperatures, and the mixing of surface waters by winds and waves limit the daily warming. Natural surface water temperatures in San Pedro Bay range from 12.5 to 25.3°C annually (EQA/MBC 1977).

When there is a large difference between surface and bottom water temperatures, a steep thermal gradient may develop between adjacent water layers of different temperatures. Natural thermoclines are formed when solar radiation elevates the temperature of surface water which, in the absence of mixing, remains separated from the subsurface layer. Artificial thermoclines may result when warm water from a thermal discharge overlies cooler receiving waters. Off southern California, a reasonably sharp natural thermocline normally develops during the summer months in the upper 30 m of the water column; in winter thermoclines are generally weak or absent.

Salinity

Salinity is a measure of the concentration of dissolved salts in seawater. Although salinity is relatively constant in the open ocean, it fluctuates in coastal environments as a result of the introduction of freshwater from storm runoff and direct rainfall and evaporation from the sea surface. Salinities in the nearshore portions of San Pedro Bay show marked seasonal variation, ranging from 25.0 to 33.6 parts per thousand (ppt) through the year (EQA/MBC 1977).

Density

Seawater density varies inversely with temperature and directly with salinity at a given pressure. Density stratification in southern California is most influenced by water temperature since salinity is relatively uniform. As a result, density gradients are most pronounced when spring and summer thermoclines are present.

Dissolved Oxygen

Dissolved oxygen (DO) is used by aquatic plants and animals in metabolic processes. It is a product of photosynthesis and is also replenished by gaseous exchange with the atmosphere. Concentrations in the study area range from approximately 5 to 14 milligrams/liter (mg/l) (EQA/MBC 1977). High values usually result from increased photosynthetic activity and low values from decomposition of organic material or mixing of surface waters with oxygen-depleted subsurface waters.

Hydrogen Ion Concentration

Hydrogen ion concentration (pH) in southern California surface waters varies narrowly around a mean of approximately 8.0, and decreases slightly with depth. Normal pH values in San Pedro Bay range from 7.8 to 8.3 (EQA/MBC 1977).

BENEFICIAL USES OF RECEIVING WATERS

In the Water Quality Control Plan for the Los Angeles Region, the California Regional Water Quality Control Board (1994) enumerated 10 beneficial uses of coastal and tidal waters in the

nearshore zone of the Pacific Ocean. Seven of these were identified for receiving waters in the San Gabriel River tidal prism:

Industrial Service Supply

Uses which do not depend primarily on water quality such as mining, cooling water, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.

Water Contact Recreation

Includes all recreational uses involving body contact with water, such as swimming, wading, water skiing, skin diving, surfing, sport fishing, use in therapeutic spas, or other uses where ingestion of the water is reasonably possible.

Non-contact Water Recreation

Recreational uses which involve the presence of water, but do not necessarily require body contact, such as picnicking, sunbathing, hiking, beachcombing, camping, pleasure boating, tidepool and marine life study, hunting, and general aesthetic enjoyment.

Ocean Commercial and Sportfishing

Includes the commercial collection of fish and shellfish, including those collected for bait, plus sportfishing in the ocean, bays, estuaries, and similar non-freshwater areas.

Marine Habitat

Provides for the preservation of the marine ecosystem, including the propagation and sustenance of fish, shellfish, marine mammals, waterfowl, and marine vegetation.

Saline Water Habitat

Provides an inland saline water habitat for aquatic and wildlife resources.

Preservation of Rare and Endangered Species

Provides an aquatic habitat necessary, at least in part, for the survival of certain species established as being rare or endangered.

MATERIALS AND METHODS

SCOPE OF THE MONITORING PROGRAM

The 2001 monitoring program for the Haynes and AES Alamitos L.L.C. generating stations was conducted by MBC Applied Environmental Sciences (MBC) in accordance with specifications set forth in the NPDES Monitoring and Reporting Programs (Appendix A). The monitoring program included winter and summer water column profiling, summer sediment sampling for grain size and chemistry, mussel sampling for bioaccumulation, summer biological sampling for benthic infauna, and winter and summer trawling for fish and macroinvertebrates.

STATION LOCATIONS

The location of the monitoring stations are listed in Appendix A and shown in Figure 3. Twelve receiving water (RW) water quality and benthic monitoring stations were sampled: Nine located in San Pedro Bay and three in the San Gabriel River. Sediment grain size and chemistry samples were taken at the 12 benthic (B) stations and trawl sampling was conducted at six trawl (T) stations.

WATER COLUMN MONITORING

During both winter and summer surveys, temperature ($^{\circ}\text{C}$), dissolved oxygen (DO), hydrogen ion concentration (pH), and salinity (ppt) were measured throughout the water column during flood and ebb tides at each of the 12 stations. At the nine receiving water monitoring stations in San Pedro Bay, Stations RW1 to RW9 (Figure 3), water quality parameters were measured continuously throughout the water column using an SBE 9/17 CTD water quality profiling system (Sea-Bird), and averaged at 1.0-meter (m) intervals. Data were transferred in the field from the Sea-Bird to floppy disk for storage. In the laboratory, data from both surveys were processed using Sea-Bird proprietary software (SeaSoft ver. 4.21). Measurements at the three river stations, Stations RW10 - RW12 (Figure 3), were obtained using a Horiba water quality analyzer at 1-m intervals.

SEDIMENT MONITORING

Sediment Grain Size

One sediment sample for grain size analysis was collected during the summer survey at each of the 12 benthic stations, Stations B1 - B12 (Figure 3). Samples were collected by biologist-divers in a 15-cm-long by 3.5-cm-diameter plastic core tube, and transported to the surface. Samples were placed in labeled plastic bags for later laboratory analysis. The size distributions of sediment particles were determined using two techniques: laser light diffraction to measure the amount and patterns of light scattered by a particle's surface for the sand/silt/clay fraction, and standard sieving for the gravel fraction. Laboratory data from the two methods were combined and are presented in tabular format (Appendix B). Resulting analyses include mean and median grain size, standard deviation of the grain size, sorting, skewness, and kurtosis. Data were plotted as size-distribution curves. Additional details are provided in Appendix B.

Sediment Chemistry

Three replicate sediment samples were collected in glass jars by biologist-divers in summer from each benthic station (Stations B1 - B12) for chemical analyses (Figure 3). Samples were placed on ice in the field and maintained at approximately 4°C until laboratory procedures began. Replicates were combined in the laboratory and analyzed for total percent solids and four metals: chromium, copper, nickel, and zinc. EPA method 160.3 was used to determine percent solids and EPA method 6010 was used for metals.

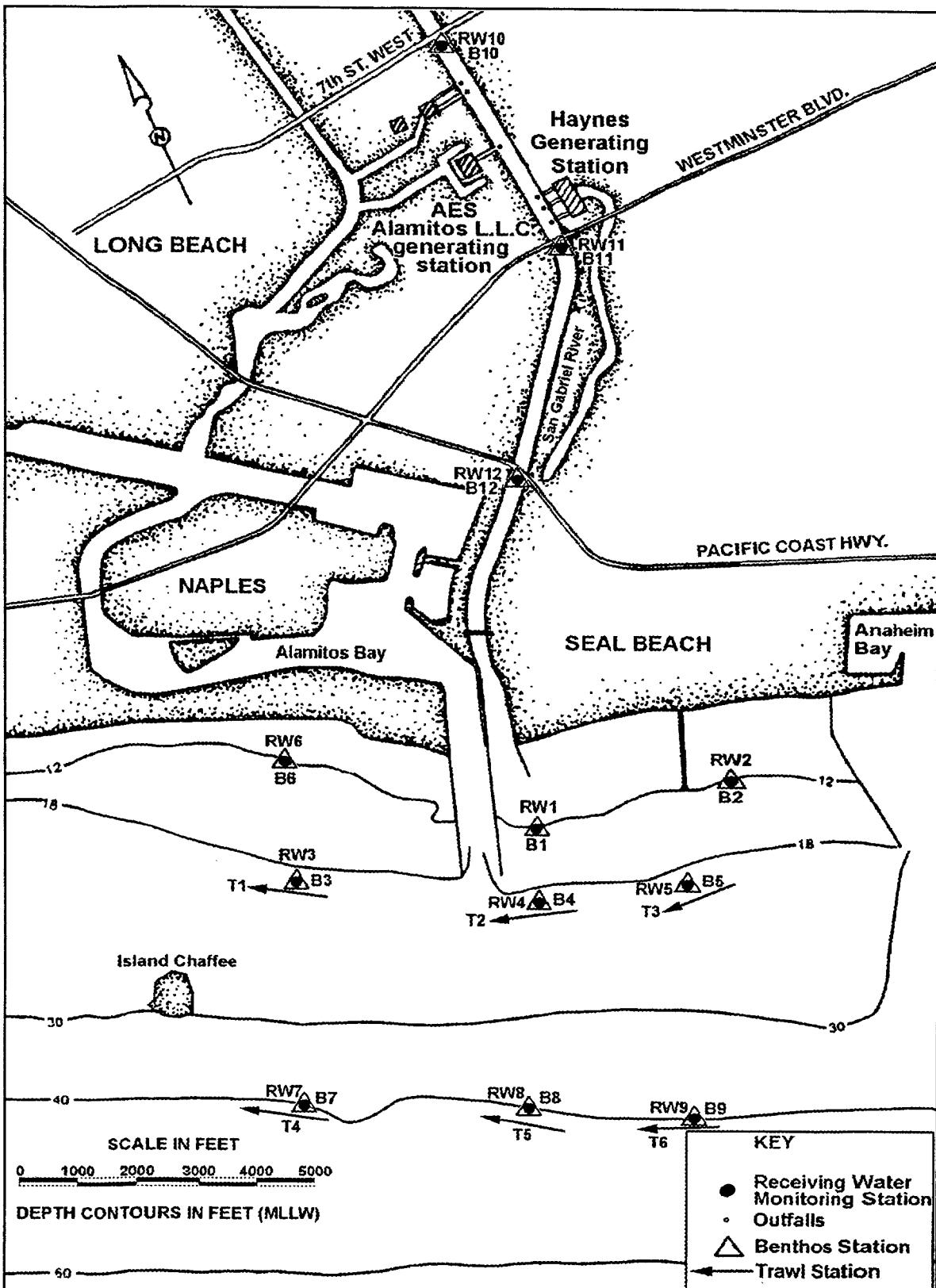


Figure 3. Locations of the monitoring stations. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

MUSSEL BIOACCUMULATION

Bay mussels (*Mytilus edulis*) were collected near the discharges by biologist-divers for bioaccumulation monitoring. A set of 45 mussels with shell lengths ranging from 51 to 73 millimeters (mm) and averaging 60.2 mm were divided into groups (replicates) of 15 mussels each and processed according to methods used in the California Mussel Watch (Appendix A and SWRCB 1986). Soft tissue from the mussels was analyzed for copper, chromium, nickel, and zinc. Results were compared to levels found in other mussel watch programs, including bay mussels from reference sites which were collected and analyzed concurrently for another generating station's NPDES monitoring program.

BIOLOGICAL MONITORING

Biological monitoring consisted of infaunal sampling using diver-operated box corers and otter trawl sampling of fish and macroinvertebrates.

Benthic Infauna

Infaunal sampling was conducted during the summer survey at 12 stations, Stations B1 - B12 (Figure 3). At each station, four replicate cores were collected using hand-held, diver-operated box corers (Figure 4). This sampling device collects a uniform sample of 10 cm x 10 cm x 10 cm for a sample volume of 1.0 liter (l). The box corer is pushed into the sediments and a closing blade is swung across the mouth of the box. The core is then withdrawn from the sediments and sealed by a neoprene lid for transport to the surface.

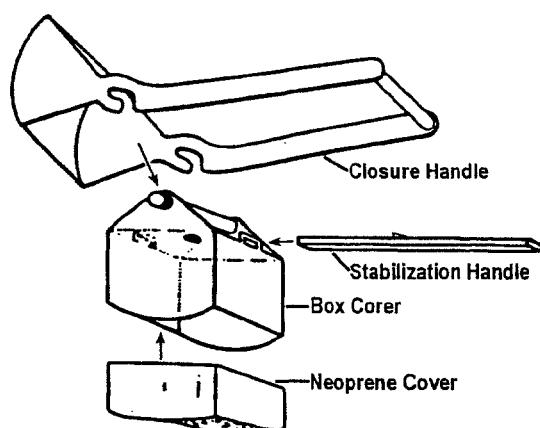


Figure 4. Diver-operated box corer used to collect infaunal samples. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Samples were washed in the field on a 0.5 mm mesh stainless steel screen, labeled, and fixed in buffered 10% formalin-seawater. In the laboratory, samples were rescreened through a 0.25 mm mesh sieve, transferred to 70% isopropyl alcohol, sorted to major taxonomic groups, identified to the lowest practical taxonomic level, and counted. Identifications and nomenclature followed the usage accepted by the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT). Representative specimens were added to MBC's reference collection.

Following identification, the weight of organisms in major taxonomic groups was obtained for each replicate. Specimens were placed on small, pre-weighed mesh screens which had been submerged in 70% isopropyl alcohol, blotted on a paper towel, and air-dried for five minutes. Total wet weight minus screen tare weight provided the wet weight of the organisms. Large organisms were weighed separately.

Fish and Macroinvertebrates

Otter trawl sampling for fishes and macroinvertebrates was conducted at Stations T1 - T6 (Figure 3). Two replicate trawls were made with a 25-foot (ft) wide Marinovich semi-balloon otter trawl net. The footrope was weighted with chain and equipped with plastic rollers to reduce fouling. The body of the net consisted of the 1.5 inch (in.) bar mesh with a 0.5 in. bar mesh liner in the cod

end. When towed along the bottom, the net inflates by the buoying effect of floats attached to the upper edge of the mouth and the hydrofoil action of the otter boards at either side.

The otter trawl was towed at 2.0 to 2.5 knots (kn) for 10 minutes and measured from the time it was on the bottom to the time retrieval commenced. Each catch was immediately separated from incidental debris, then sorted to species. Fishes were identified, enumerated, measured to standard length (SL), total length (TL), or disc width (DW), and examined for external parasites, anatomical anomalies, and other abnormalities. Aggregate weights were taken by species. Specimens were then returned to the sea along with macroinvertebrates which were identified, counted, and weighed.

Unusual specimens and those of uncertain identity were preserved in 10% formalin-seawater and returned to the laboratory for positive species identification and, if warranted, were retained in the MBC voucher collection.

Impingement

Heat treatment impingement fish sampling was conducted at all operational screenwells at Haynes and AES Alamitos L.L.C. generating stations. Samples were collected on at least two heat treatments per screenwell if they occurred during the year. A heat treatment is an operational procedure designed to eliminate mussels, barnacles, and other fouling organisms, which grow in and occlude the generating station conduits. During a heat treatment, heated effluent water from the discharge conduit is re-entrained via cross-connecting tunnels to the intake conduit until the water temperature rises to approximately 40.5°C. This temperature is maintained for a period of at least one hour. During which time all mussels, barnacles, other fouling organisms, and occasionally fish and motile invertebrates living within the intake conduit succumb to the heated water. All material subsequently impinged onto the traveling screens is removed. The fish and macroinvertebrates are then separated from incidental debris, sorted by species, identified, and counted. Fish are measured in millimeters to either SL, TL or DW, as appropriate, and examined for external parasites, anatomical anomalies, and other abnormalities. Aggregate weights are taken by species for both fish and macroinvertebrates. Unusual specimens and those of uncertain identity are preserved in 10% formalin-seawater and returned to the laboratory for positive species identification and, if warranted, retention in the MBC collection of voucher species. Data are collected for each heat treatment survey to determine the total impingement loss for the year.

STATISTICAL ANALYSES

Summary statistics developed from the biological data included the number of individuals (expressed as both trawl and per standard area), number of species and Shannon-Wiener (Shannon and Weaver 1962) species diversity (H') index.

The diversity equation is as follows:

Shannon-Wiener

$$H' = - \sum_{j=1}^S \frac{n_j}{N} \ln \frac{n_j}{N}$$

where: H' = species diversity
 n_j = number of individuals in the j^{th} species
 S = total number of species
 N = total number of individuals
 j = each species

Data from trawl and infaunal coring collections were subjected to log transformations (when necessary) and classified (clustered) using the SYSTAT (SYSTAT ver. 5.0, Systat, Inc., Evanston, IL) clustering module (Wilkinson 1986). Cluster analysis provides a graphic representation of the relationship between species, their individual abundance, and spatial occurrence among the stations sampled. In theory, if physical conditions were identical at all stations, the biological community would be expected to be identical as well. In practice this is never the case, but it is expected that the characteristics of adjacent stations would be more similar than those distant from one another. The dendrogram shows graphically the degree of similarity (and dissimilarity) between observed characteristics and the expected average. The two-way analysis utilized in this study illustrates groupings of species and stations, as well as their relative abundance, expressed as a percent of the overall mean. Two classification analyses are performed on each set; in one (normal analysis) the sites are grouped on the basis of the species which occurred in each, and in the other (inverse analysis) the species are grouped according to their distribution among the sites. Each analysis involves three steps. The first is the calculation of an inter-entity distance (dissimilarity) matrix using Euclidean distance (Clifford and Stephenson 1975) as the measure of dissimilarity, where:

Clifford & Stephenson

$$D = \left[\sum_{1}^{n} (x_1 - x_2)^2 \right]^{1/2}$$

D	=	Euclidean distance between two entities
x_1	=	score for one entity
x_2	=	score for other entity
n	=	number of attributes

The second procedure, referred to as sorting, clusters the entities into a dendrogram based on their dissimilarity. The group average sorting strategy is used in construction of the dendrogram (Boesch 1977). In step three, the dendograms from both the site and species classifications are combined into a two-way coincidence table. The relative abundance values of each species are replaced by symbols (Smith 1976) and entered into the table. In the event of extreme high abundance of a single species, abundance data are transformed using a natural log transformation [$\ln(x)$].

DETECTION LIMITS

Detection limits (DL) used in reporting chemistry results are interpreted as the smallest amount of a given analyte that can be measured above the random noise inherent in any analytical tool. Thus, any value below the DL cannot be considered a reliable estimate of analyte concentration. Therefore, where a test for a given analyte results in a level below the DL, a "none detected" (ND) value has been assigned. The complication of what numerical value to substitute for ND in statistical calculations is addressed by EPA (1989, Section 5.3.3). When values for a given analyte are ND for all stations, then means and standard deviations will also be considered ND. However, when an analyte is detected at some stations and not at others, statistical calculations can be made by substituting ND values with either (a) zero, (b) one-half the average detection limit, or (c) the average detection limit (EPA 1989). Determining which substitution to use is based on whether or not substantial information exists to support the historical presence or absence of a given analyte at the station location. Since chemistry analyses have repeatedly resulted in ND values at the same stations through past surveys, ND values have been replaced with zeros in performing statistical calculations. This decision is also based on the fact that detection limits differ in virtually all past surveys, which would confound any yearly comparison if options (b) or (c), from above, are used. Historical raw data are presented in the appendices for possible supplementary study.

RESULTS

FIELD OPERATIONS

The 2001 NPDES surveys for Haynes and AES Alamitos L.L.C. generating stations were conducted on 16 and 20 March, 25 June, and 5 and 18 September 2001. The latitude and longitude for all receiving water (RW), benthic (B), and trawl (T) stations are listed in Table 1.

Winter

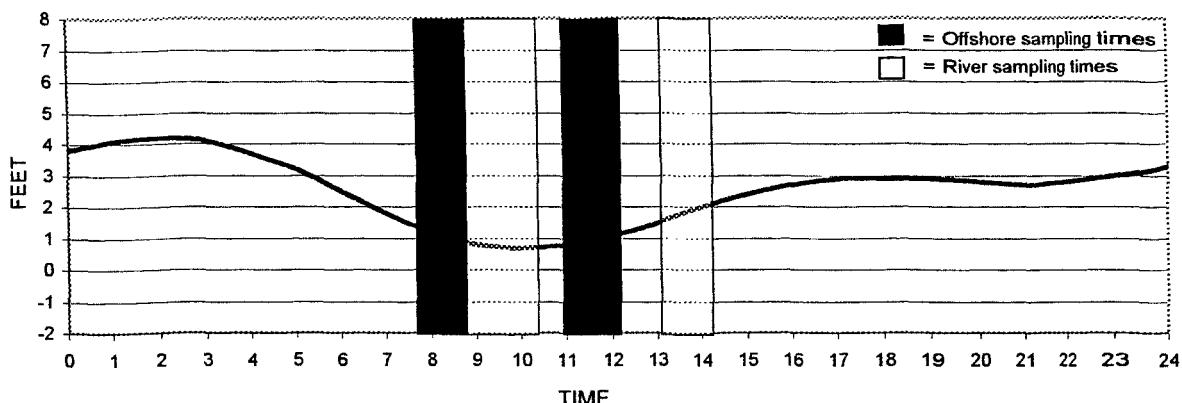
Water quality data at Stations RW1 through RW12 (Figure 3) were collected on 16 March during two tidal periods (Figure 5). At ocean Stations RW1 through RW9, ebb tide was sampled between 0745 and 0855 hr (+1.3 to +0.8 ft Mean Lower Low Water [MLLW]), and flood tide between 1055 and 1210 hr (+0.8 to +1.1 ft MLLW). At San Gabriel River Stations RW10 through RW12, ebb tide was sampled between 0855 and 1042 hr (+1.8 to +0.9 ft MLLW), and flood tide between 1308 and 1432 hr (+0.8 to +2.2 ft MLLW). Tide heights at river stations were adjusted for tidal delay as it moved upriver (approximately 2 hr at the furthest upriver station). Skies were overcast to mostly cloudy with light wind from the southwest to west at less than 10 kn. Seas were south-southwest at 1 to 2 ft throughout the day.

Otter trawl sampling was conducted on 20 March between 0815 and 1630 hr at Stations T1 through T6. Skies were overcast, changing to clear, with winds from the south at less than 5 kn changing to west to south-southwest at 15 to 20 kn. Seas were flat to southwest at 3 ft during the day.

No oil film or grease was seen at any station during the winter sampling. Plastic and paper debris were noted at Stations RW3, RW9, T1, T4, and T5. Drift algae was noted at Stations RW8 and RW9. The water was slightly turbid at Stations RW6 and T4. Red tide (plankton bloom) was noted at Stations RW3, RW6, and RW9. Western gulls (*Larus occidentalis*) were observed throughout the study area during the trawl and water quality surveys; Heermann's gulls (*Larus heermanni*) were seen at Stations RW5 and RW7 on ebb tide, and Station T4. Western grebes (*Aechmophorus occidentalis*) were seen at Stations RW4, RW5, and T3; cormorants (*Phalacrocorax* sp.) were seen at Stations RW5 and RW9; and surf scoters (*Melanitta perspicillata*) were seen at Stations RW4, RW5 and RW6. Caspian terns (*Sterna caspia*) were seen at Stations RW7, RW9, and T3, and Forster's tern (*Sterna forsteri*) were seen at Stations RW2 and RW9. A snowy egret (*Egretta thula*) and American coots (*Fulica americana*) were seen at Station RW10. A California sea lion (*Zalophus californianus*) was seen at Station T5. California brown pelicans (*Pelecanus occidentalis californicus*) were present at Stations RW4, RW5, RW6, RW8, T3, T4, and T6. No California least terns (*Sterna antillarum browni*) were observed during any component of the winter surveys.

Table 1. Latitude/longitude coordinates of sampling stations. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Stations			
Water Quality	Benthic	Latitude	Longitude
RW1	B1	33°44.15'	118°07.05'
RW2	B2	33°44.13'	118°06.40'
RW3	B3	33°44.33'	118°07.81'
RW4	B4	33°43.98'	118°07.14'
RW5	B5	33°43.79'	118°06.61'
RW6	B6	33°44.67'	118°07.63'
RW7	B7	33°43.67'	118°08.25'
RW8	B8	33°43.36'	118°07.65'
RW9	B9	33°43.05'	118°07.18'
RW10	B10	33°46.43'	118°05.86'
RW11	B11	33°45.62'	118°05.89'
RW12	B12	33°45.18'	118°07.63'
Trawl			
Stations	Heading	Latitude	Longitude
T1	288°	33°44.31'	118°07.55'
T2	294°	33°43.77'	118°06.75'
T3	278°	33°43.73'	118°06.26'
T4	270°	33°43.61'	118°08.18'
T5	268°	33°43.50'	118°07.51'
T6	273°	33°42.98'	118°06.87'



NOTE: River sampling times were corrected for 2 hour tidal lag.

Pacific Standard Time		Friday		March 16, 2001	
Time	Height	Time	Height	Time	Height
0158	4.2'	1009	0.7'	1741	2.9'
				2102	2.7'

Figure 5. Tidal rhythms during water column sampling, winter survey. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

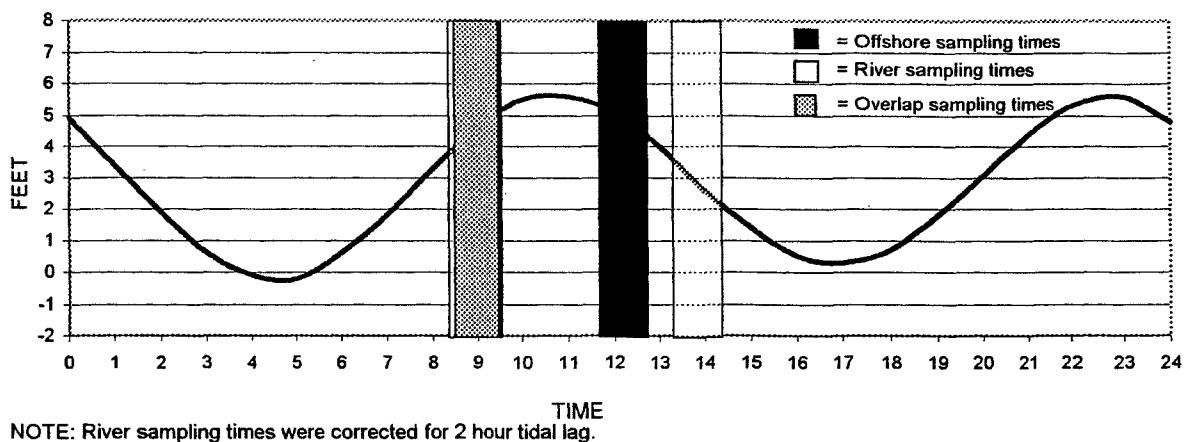
Summer

Biologist-divers collected sediment cores for analysis of infauna composition, sediment grain size, and chemical analyses on 25 June. Winds were from the south to southwest from 1 to 15 kn, and seas were from the south to southwest at 1 to 2 ft. Skies were partly cloudy to clear during the day.

Otter trawl sampling was conducted on 5 September between 0740 and 1345 hr at Stations T1 through T6. Skies were overcast all day with light southwest to south winds to 6 kn. Seas were southwest at 1 ft during the day.

Water quality data were collected on 18 September during two tidal periods (Figure 6). At ocean Stations RW1 through RW9, flood tide was sampled between 0830 and 0940 hr (+4.0 to +5.2 ft MLLW), and ebb tide between 1140 and 1245 hr (+5.3 to +4.3 ft MLLW). At San Gabriel River Stations RW10 through RW12, flood tide was sampled between 0820 and 0945 hr (+1.0 to +2.6 ft MLLW), and ebb tide between 1315 and 1430 hr (+5.5 to +4.6 ft MLLW). Tide heights at river stations were adjusted for tidal delay as it moved upriver (approximately 2 hr at the furthest upriver station). Skies were overcast changing to clear with light wind from the south to southwest at less than 6 kn. Seas were south-southwest from 1 to 3 ft throughout the day.

No floatables, oil or grease was seen at any of the stations. Red tide was observed at Stations B8 and B9. The water was slightly turbid at Stations RW1 and RW4. Western gulls were seen at Stations B2, B3, T1, T6, RW2, RW4, RW5, RW7, RW8 and RW11. Heermann's gulls were seen at Stations B7, T3, T4, T5, and RW9; an unidentified gull (*Larus spp.*) was seen at Station T4. Forster's terns were seen at Stations B1, B3, B4, and B8 and Caspian terns at Stations B4, B5, T2, T3, RW3, and RW10. Brandt's cormorants (*Phalacrocorax penicillatus*) were seen at Stations RW10 and RW11, and a snowy egret and great egrets (*Ardea alba*) were seen at Station RW10. A green sea turtle (*Chelonia mydas*) was seen at Station RW11. California brown pelicans were seen at most trawl stations, and at Stations B2, RW1, RW2, RW3, RW4, RW7, RW10, and RW12. No California least terns were seen during any component of summer sampling.



Pacific Daylight Time		Tuesday		September 18, 2001	
Time	Height	Time	Height	Time	Height
0433	-0.2'	1041	5.6'	1651	0.3'
				2254	5.6'

Figure 6. Tidal rhythms during water column sampling, summer survey. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

WATER COLUMN MONITORING

Water quality data are provided in Figures 7 through 10 and are summarized in Tables 2 and 3; raw data are presented in Appendix C.

Temperature

In winter, temperature profiles at the nine offshore stations were similar between ebb and flood tides except for Station RW4 in the upper two meters of the water column, where flood tide temperatures were 4°C higher than during ebb tide (Figure 7, Appendix C). The maximum surface-to-bottom differential during ebb tide recorded was 8.66°C at Station RW1. During ebb tide, surface temperatures at San Pedro Bay stations averaged 17.46°C, ranging from 14.53°C at Station RW7, offshore and upcoast of the San Gabriel River mouth, to 23.47°C at Station RW1, at the river mouth (Table 2). During flood tide, the maximum difference between surface and bottom was recorded at Station RW4 (7.73°C). Surface temperatures during flood tide averaged 18.09°C, ranging from 15.37°C at Station RW8, offshore of the river mouth, to 22.48°C at Station RW1. Near-bottom temperatures during ebb tide ranged from 13.64°C at Station RW8 to 15.86°C at Station RW2, downcoast of the river mouth, and averaged 14.37°C. During flood tide, near-bottom temperatures averaged 14.36°C and ranged from 13.61°C at Station RW9 to 15.39°C at Station RW2.

Surface water temperatures in winter at stations in the San Gabriel River were, on average, approximately 6°C warmer than offshore, with surface temperatures averaging 23.37°C on ebb tide and 24.40°C on flood tide (Table 3, Figure 7). Bottom temperatures were similarly higher, averaging 22.77°C on ebb tide and 24.40°C on flood tide. There was a maximum of a 2.6°C difference between surface and bottom temperatures at all station. Overall, the lowest temperature (22.10°C) was measured at the surface at Station RW10 (furthest upriver) on flood tide; highest temperature (26.40°C) was measured on the surface at Station RW12 (furthest downstream from the generating stations) during flood tide.

In summer, surface water temperature in San Pedro Bay during ebb tide averaged 20.45°C, ranging from 19.50°C at Station RW5 to 22.71°C at Station RW4 (Table 2, Figure 7, and Appendix C). Flood tide surface water temperatures were slightly lower than ebb tide values,

averaging 19.62°C and ranging from 18.51°C at Station RW8 to 20.23°C at Station RW1, offshore of the river mouth at a depth of 12 feet. Near-surface thermoclines were detected at Stations RW1 during ebb tide and RW4 during flood tide. A thermocline was present at 7 to 10 m depth in the water column at Station RW7. In general, surface temperatures and water column temperature profiles were similar between tides, with afternoon ebb tide temperatures slightly warmer than those recorded during the morning flood tide. Surface waters at Station RW1 were warmer during ebb tide than during flood tide. Temperatures decreased with depth at all stations. Near-bottom temperatures averaged 17.49°C and 17.59°C during ebb and flood tides, respectively.

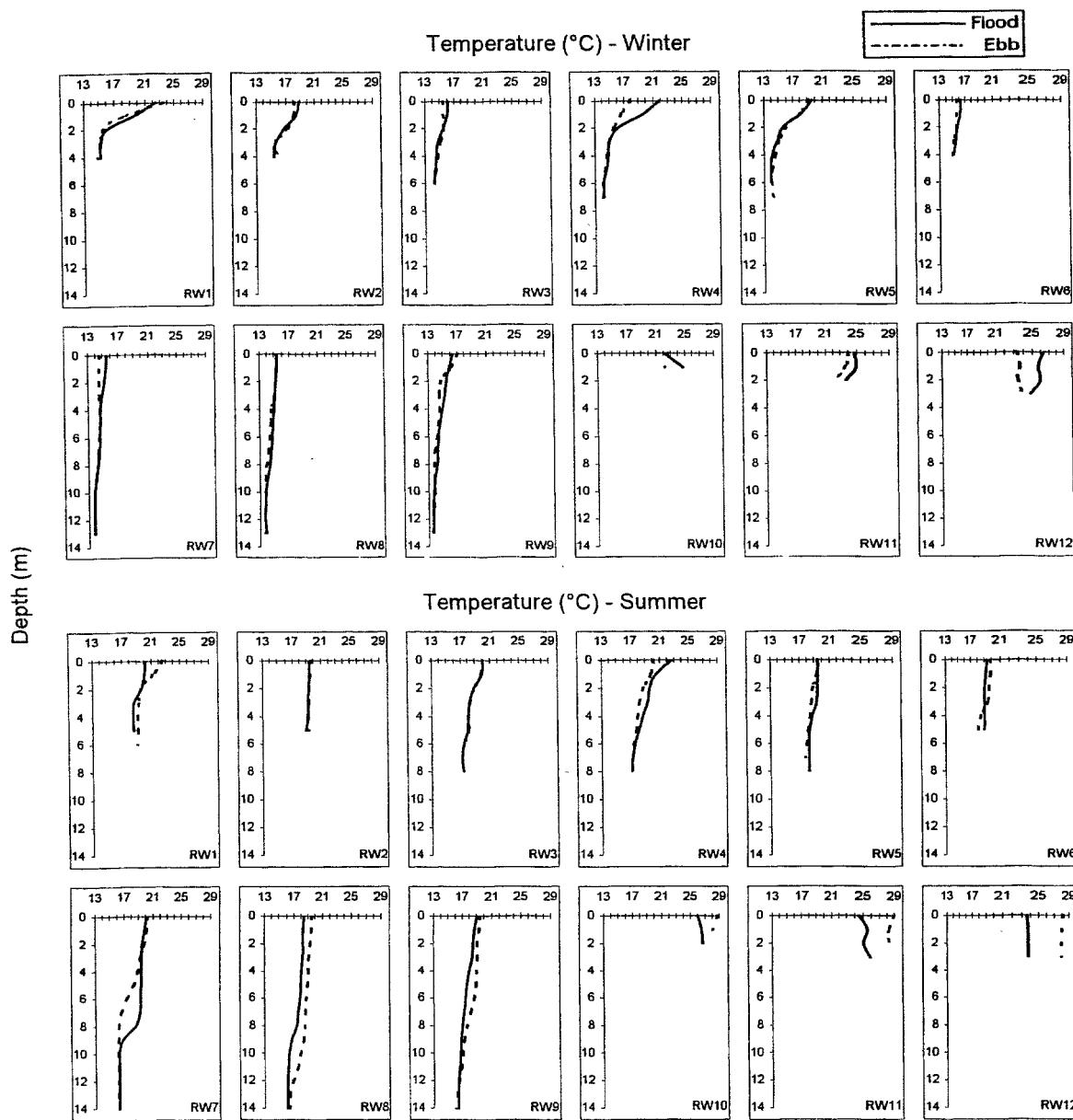


Figure 7. Temperature vertical profiles during ebb and flood tides. Haynes and AES Alamitos L.L.C. Generating Stations NPDES, 2001.

Surface temperatures at stations in the San Gabriel River were greater than those recorded at Stations RW1 and RW4 during both tides (Table 3, Figure 7). Surface temperatures in the river averaged 28.71°C on ebb tide and 24.67°C on flood tide. Bottom temperatures were similarly higher, averaging 28.12°C on ebb tide and 25.44°C on flood tide. The lowest temperature (23.55°C) was measured on the surface at Station RW12 on flood tide; highest temperature (29.11°C) was measured at the surface at Station RW11 on ebb tide.

Table 2. Summary of water quality parameters during ebb and flood tides at offshore stations. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

	Temp. (°C)	D.O. (mg/l)	pH	Salinity (ppt)	Temp. (°C)	D.O. (mg/l)	pH	Salinity (ppt)
Winter								
Surface								Bottom
Mean	ebb 17.46	flood 18.09	ebb 8.49	flood 8.93	ebb 8.14	flood 8.15	ebb 31.53	flood 31.58
Minimum	ebb 14.53	flood 15.37	ebb 6.53	flood 6.90	ebb 7.92	flood 7.93	ebb 28.77	flood 30.18
Maximum	ebb 23.47	flood 22.48	ebb 10.18	flood 12.19	ebb 8.27	flood 8.41	ebb 32.92	flood 32.78
Summer								
Surface								Bottom
Mean	ebb 20.45	flood 19.62	ebb 7.10	flood 7.00	ebb 7.94	flood 7.94	ebb 33.25	flood 33.28
Minimum	ebb 19.50	flood 18.51	ebb 6.36	flood 6.67	ebb 7.79	flood 7.91	ebb 32.56	flood 33.04
Maximum	ebb 22.71	flood 20.23	ebb 7.41	flood 7.22	ebb 7.97	flood 7.98	ebb 33.54	flood 33.50

Dissolved Oxygen

In winter, dissolved oxygen (DO) concentration profiles in San Pedro Bay during both flood and ebb tides were similar at Stations RW1, RW2, RW4, and RW5, and dissimilar to profiles at RW3, RW6, RW7, RW8, and RW9 (Figure 8). Values generally increased to 4 to 6 m depth, then decreased to the bottom. Values fluctuated widely throughout the water column, with a maximum surface-to-bottom differential during flood tide of 5.29 mg/l and 3.65 mg/l during ebb tide (Table 2, Figure 8, and Appendix C). Mean surface DO concentration during ebb tide was 8.49 mg/l, and values ranged from 6.53 mg/l at Station RW1 to 10.18 mg/l at Station RW3, offshore at 20-ft depth and upcoast of the river mouth. During flood tide, mean surface DO concentration was 8.93 mg/l, and values ranged from 6.90 mg/l at Station RW1 to 12.19 mg/l at Station RW6. Near-bottom DO concentrations averaged 7.75 mg/l during ebb tide and 8.11 mg/l during flood tide.

Table 3. Summary of water quality parameters during ebb and flood tides at San Gabriel River stations. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

	Temp. (°C)	D.O. (mg/l)	pH	Salinity (ppt)	Temp. (°C)	D.O. (mg/l)	pH	Salinity (ppt)
Winter								
Surface								Bottom
Mean	ebb 23.37	flood 24.40	ebb 6.00	flood 6.87	ebb 7.77	flood 7.83	ebb 5.00	flood 4.00
Minimum	ebb 22.70	flood 22.10	ebb 5.60	flood 5.20	ebb 7.65	flood 7.72	ebb 5.00	flood 4.00
Maximum	ebb 24.10	flood 26.40	ebb 6.30	flood 9.40	ebb 7.89	flood 7.93	ebb 5.00	flood 4.00
Summer								
Surface								Bottom
Mean	ebb 28.71	flood 24.67	ebb 4.62	flood 4.58	ebb 7.68	flood 7.63	ebb 28.05	flood 29.81
Minimum	ebb 28.24	flood 23.55	ebb 3.30	flood 3.44	ebb 7.47	flood 7.51	ebb 18.44	flood 22.73
Maximum	ebb 29.11	flood 25.93	ebb 5.32	flood 5.25	ebb 7.79	flood 7.78	ebb 32.98	flood 33.61

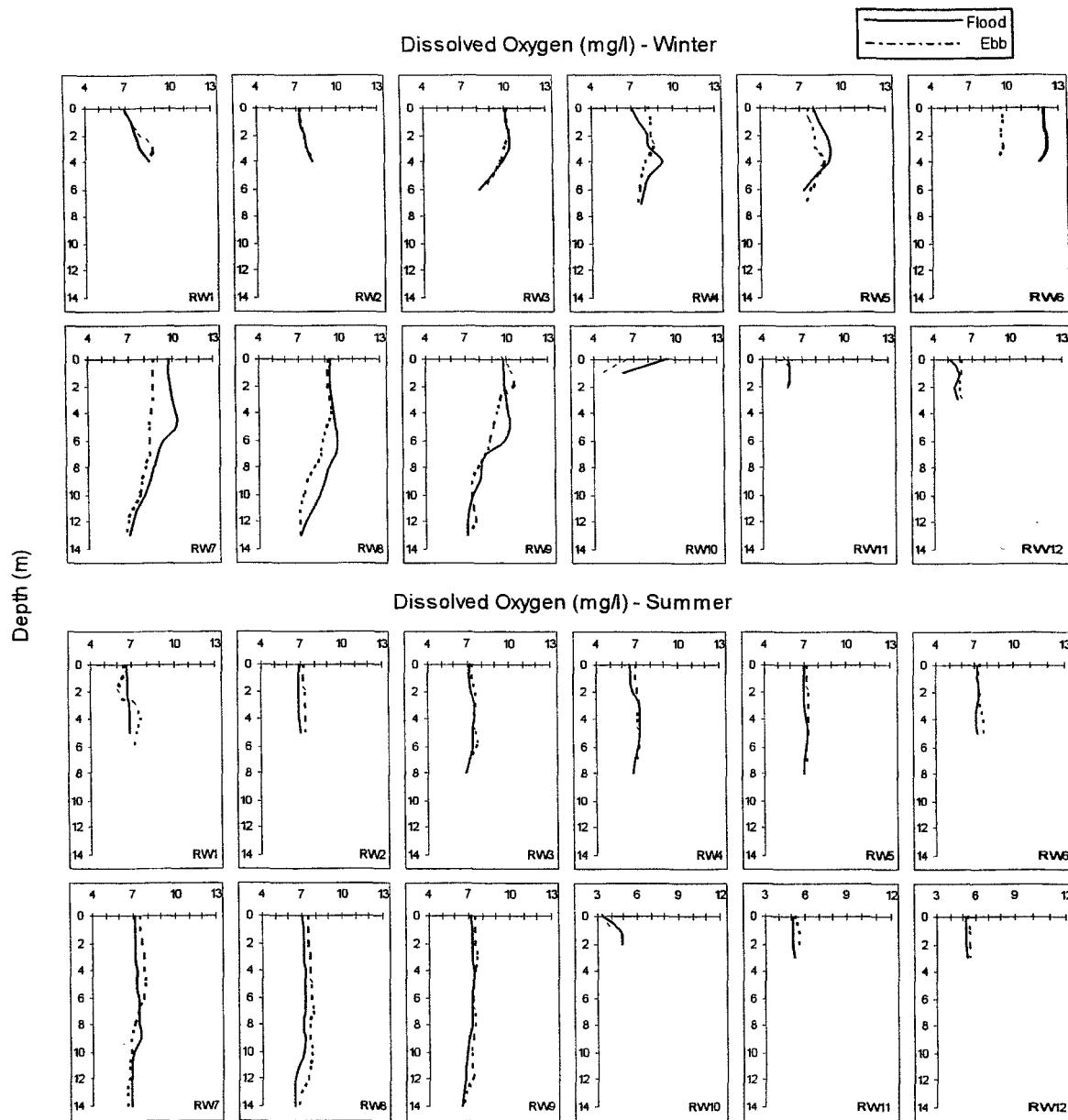


Figure 8. Dissolved oxygen vertical profiles during ebb and flood tides. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

San Gabriel River dissolved oxygen concentrations were somewhat lower than values recorded at offshore stations. Surface DO concentrations at the three river stations averaged 6.00 mg/l during ebb tide and 6.87 mg/l during flood tide, while bottom DO concentrations averaged 5.50 mg/l on ebb tide and 5.97 mg/l on flood tide (Table 3, Figure 8). DO profiles at Stations RW11 and RW12 were nearly vertical and values were similar during both tidal cycles (difference was less than 1 mg/l). At Station RW10, however, DO values were more variable from surface to bottom during both tides, and flood tide values were higher than those recorded during ebb tide. During ebb tide at Station RW10, DO fell from 9.40 mg/l at the surface to 6.20 mg/l at a depth of 1 m, while during flood tide values dropped from 6.30 mg/l to 4.50 mg/l. At Station RW11 during ebb tide, DO at the surface was 5.60 mg/l and 6.00 mg/l on flood tide. Near the bottom DO was 5.90 mg/l on both tides.

Station RW12 surface DO values were 5.20 mg/l on flood tide and 6.10 on ebb tide. Bottom DO values at Station RW12 were 5.80 mg/l on flood tide and 6.10 mg/l on ebb tide.

In summer, surface DO concentrations in San Pedro Bay averaged 7.10 mg/l during ebb tide and 7.00 mg/l during flood tide (Table 2, Figure 8, and Appendix C). During ebb tide, surface DO values ranged from 6.36 mg/l at Station RW1 to 7.41 mg/l at Station RW7. During flood tide, DO concentrations at the surface ranged from 6.67 mg/l at Station RW1 to 7.22 mg/l at Station RW6. Most profiles were vertical with a slight decrease from top to bottom on both tides. At Station RW1, the profile on the ebb tide initially dropped, increased at 2 to 4 m, then dropped again to the bottom. Ebb tide DO concentrations at most San Pedro Bay stations were slightly higher than earlier flood tide DO values. During both tides, bottom DO concentrations were slightly lower (less than 1 mg/l) than surface DO concentrations at most stations during ebb and flood tides. Near-bottom DO concentrations averaged 6.98 mg/l during ebb tide and 6.85 mg/l during flood tide. The maximum surface-to-bottom DO differentials were at Station RW7 (0.91 mg/l) during ebb tide and at Station RW9 (0.68 mg/l) during flood tide.

DO concentrations in the San Gabriel River were lower than values recorded at the San Pedro Bay stations (Figure 8). While profiles at Stations RW11 and RW12 were near vertical, DO values at Station RW10 were low on both tides, increasing from 3.44 mg/l at the surface to 4.86 mg/l at the bottom (at a depth of 2 m) during flood tide. During ebb tide, dissolved oxygen values were slightly lower at Station RW10, with a surface value of 3.30 mg/l and a bottom value of 3.96 mg/l (at a depth of 1 m). Surface DO averaged 4.62 mg/l on ebb tide and 4.58 mg/l on flood tide; bottom DO concentrations averaged 4.96 mg/l during ebb tide and 5.13 mg/l during flood tide (Table 3, Figure 8).

Hydrogen Ion Concentration

In winter, mean surface pH at the offshore stations was 8.14 during ebb tide and 8.15 during flood tide (Table 2, Figure 9, and Appendix C). Surface values ranged from 7.92 to 8.27 during ebb tide, and from 7.93 to 8.41 during flood tide. Hydrogen ion values generally increased to two meters and then slowly decreased throughout the remainder of the water column during flood tide. During ebb tide, pH at most stations decreased slowly to the bottom.

In the San Gabriel River, winter surface pH values averaged 7.77 during ebb tide and 7.83 during flood tide (Table 3, Figure 9). During ebb tide, values ranged from 7.65 to 7.89, while flood tide pH values ranged from 7.72 to 7.93.

In summer, mean surface pH at the offshore stations was 7.94 during both tides (Table 2, Figure 9, and Appendix C). Values were nearly uniform throughout the water column, except at Station RW1, where values in the upper 2 m of the water column on ebb tide were lower than values below. Surface values ranged from 7.79 to 7.97 during ebb tide and 7.91 to 7.98 during flood tide. Mean near-bottom pH values were 7.92 during both tides.

San Gabriel River surface pH values in summer averaged 7.68 during ebb tide and 7.63 during flood tide (Table 3, Figure 9). Ebb and flood tide profiles at Stations RW10 and RW11 were near-vertical during both tides. At Station RW12, however, values were lower on flood tide than those recorded during ebb tide. Surface pH values were generally lower than near-bottom pH values. Surface values ranged from 7.47 to 7.79 during ebb tide and 7.51 to 7.78 during flood tide. Mean near-bottom pH values were 7.75 during ebb tide and 7.77 during flood tide.

Salinity Concentration

In winter, mean surface salinity at the offshore stations was 31.53 parts per thousand (ppt) during ebb tide and 31.58 ppt during flood tide (Table 2, Figure 10, and Appendix C). Surface values

ranged from 28.77 to 32.92 ppt during ebb tide, and from 30.18 to 32.78 ppt during flood tide. Salinity values generally increased greatly to three meters depth and then slowly increased throughout the remainder of the water column during both tides. Bottom salinity averaged 33.18 ppt on ebb tide and 33.19 ppt on flood tide.

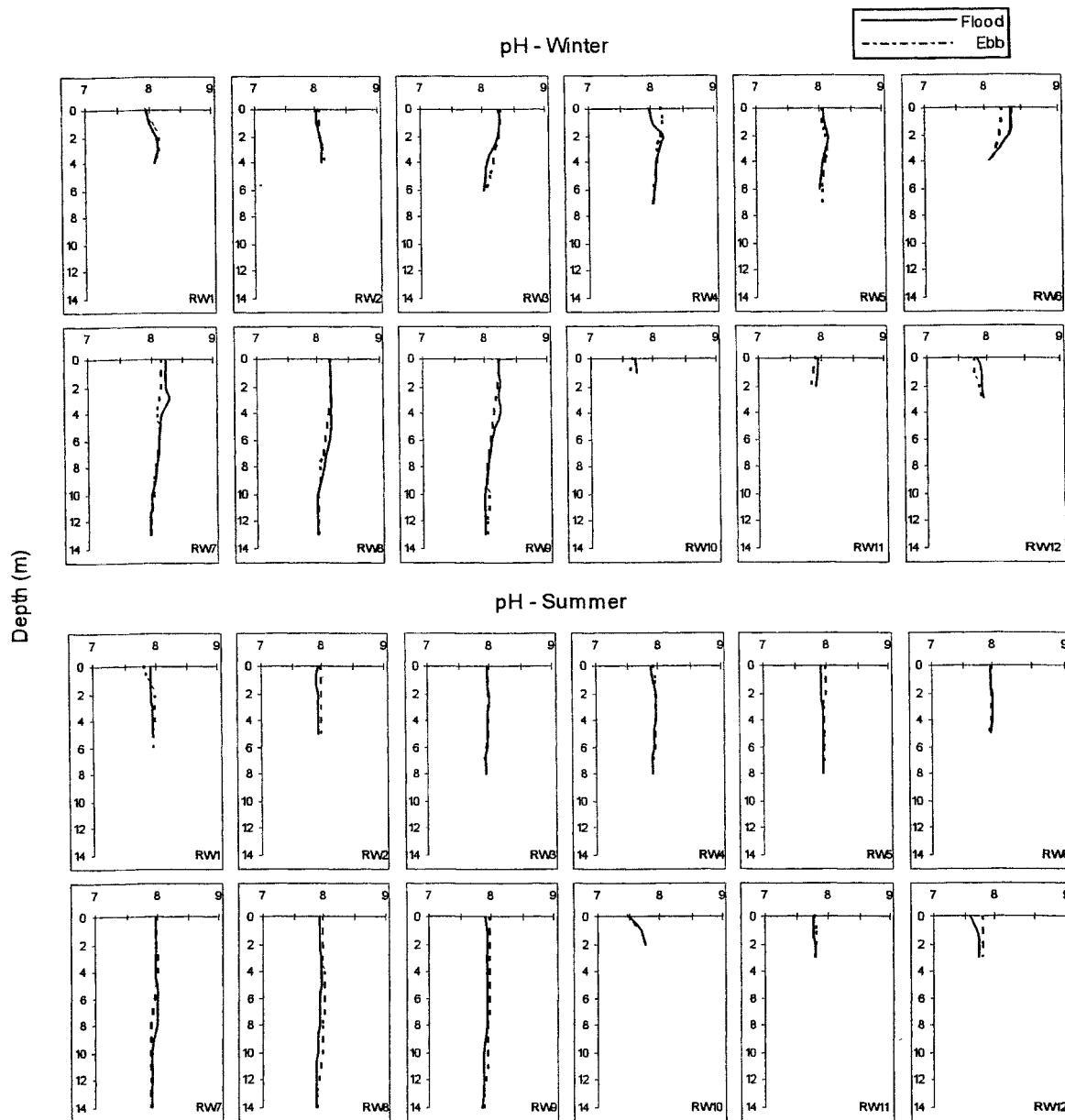
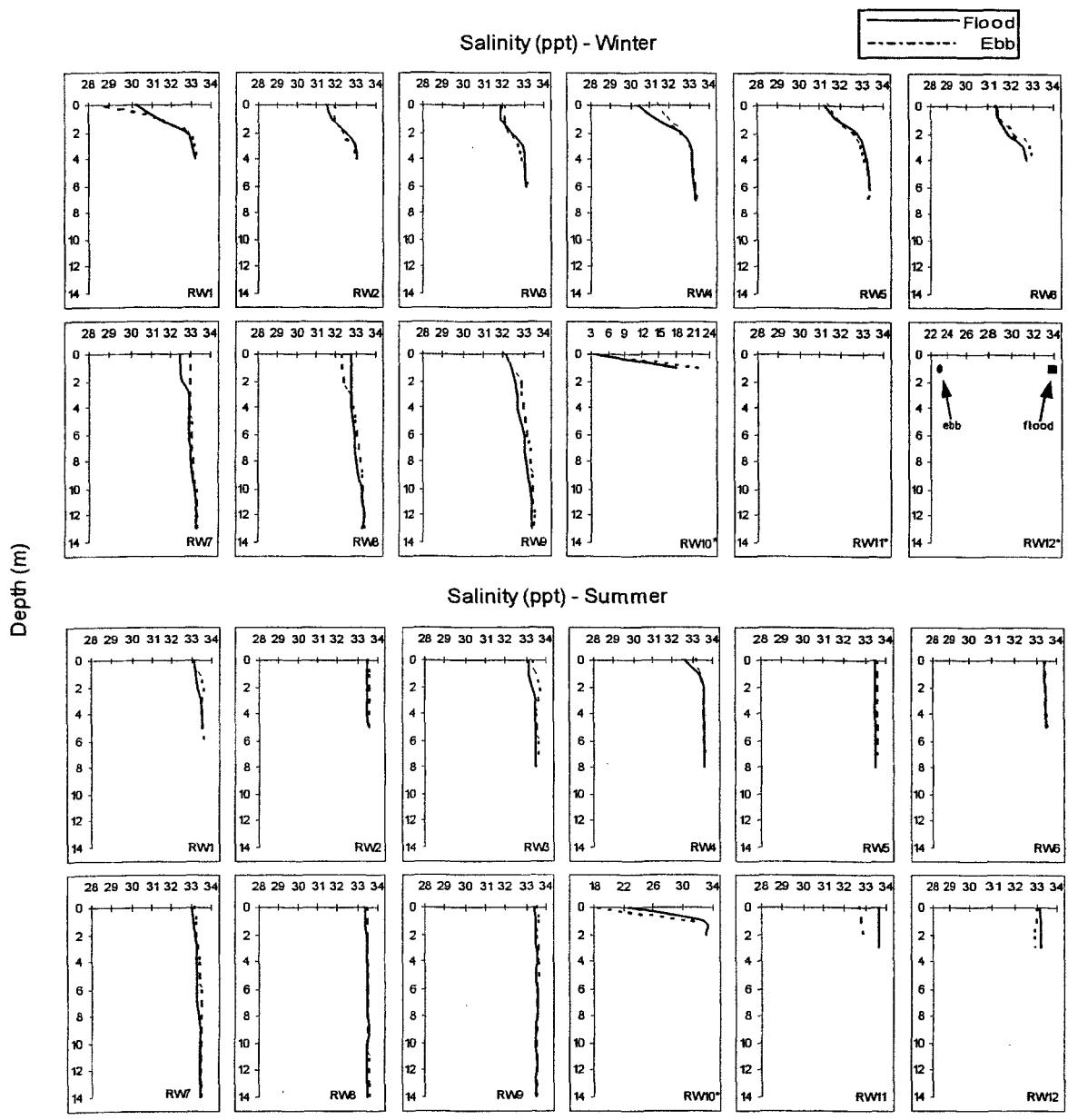


Figure 9. Hydrogen ion concentration (pH) vertical profiles during ebb and flood tides. Haynes and AES Alamitos L.L.C. Generating Stations NPDES, 2001.

In the San Gabriel River in winter, surface and bottom salinity values were taken only at Station RW10 (the furthest station upriver); values ranged from 5 ppt on the surface to 23 ppt at one meter depth during ebb tide and 4 ppt on the surface to 18 ppt at one meter during flood tide (Table 3, Figure 10). At Station RW12, salinity was taken at one meter on both ebb (23 ppt) and flood tides (34 ppt).



*X-axis range differs for River Stations RW10 during winter and summer, and RW2 during winter. No data available for RW11 during winter.

Figure 10. Salinity vertical profiles during ebb and flood tides. Haynes and AES Alamitos L.L.C. Generating Stations NPDES, 2001.

In summer, mean surface salinity at the offshore stations was 33.25 ppt during ebb tide and 33.28 ppt during flood tide (Table 2, Figure 10, and Appendix C). Values were nearly uniform throughout the water column, except at Stations RW1, RW3, and RW4, where values in the upper 2 m of the water column varied during the tidal cycles. Surface and bottom salinity values varied less than 1 ppt throughout the water column during both tides. Mean near-bottom salinity values were slightly higher than surface values averaging 33.54 ppt on ebb tide and 33.50 ppt on flood tide.

San Gabriel River salinity surface values in summer averaged 28.05 ppt during ebb tide and 29.81 during flood tide (Table 3, Figure 10). Ebb tide surface values ranged from 18.44 ppt at Station RW10 to 32.98 ppt at Station RW12, while flood tide surface values ranged from 22.73 ppt

at Station RW10 to 33.61 ppt at Station RW 11. Bottom salinity values were more uniform with a mean of 32.58 on ebb tide and 33.27 on flood tide.

SEDIMENT MONITORING

Sediment Grain Size

Sediment grain size distribution curves and grain size characteristics at each station are presented in Appendix D. Sediment grain size parameters are summarized in Table 4. Grain size is expressed in phi (ϕ) units, which are inversely related to grain diameter in millimeters (mm) (Appendix B). Sediment grain size values for the offshore stations and the three stations in the San Gabriel River (B10, B11, and B12) are reported separately.

Table 4. Sediment grain size parameters, Stations B1 - B9. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Parameter	Upcoast			River Mouth Area			Downcoast			Mean	S.D.
	B3	B6	B7	B1	B4	B8	B2	B5	B9		
% Gravel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% Sand	86.9	88.6	49.8	84.6	86.8	87.7	91.0	77.6	71.4	80.5	13.0
% Silt	11.1	9.7	35.8	12.0	10.9	9.1	7.3	19.6	24.9	15.6	9.4
% Clay	2.0	1.7	14.4	3.4	2.3	3.2	1.7	2.8	3.8	3.9	4.0
Mean grain size											
phi	3.28	3.03	4.43	3.23	3.20	2.55	3.18	3.56	3.55	3.26	0.51
μm	103	123	47	107	109	171	110	85	85	104.4	33.3
Sorting (ϕ)	0.77	0.94	2.69	1.06	0.78	1.44	0.67	0.82	1.26	1.16	0.63
Skewness	-0.07	-0.16	0.23	0.26	0.17	0.25	0.06	0.29	0.16	0.13	0.16
Kurtosis	1.42	1.27	0.83	1.99	1.32	1.67	1.55	1.65	1.87	1.51	0.35

Sediments in the ocean study area consisted primarily of sand, ranging from 50% sand at Station B7, upcoast of the San Gabriel River at a depth of 40 ft, to 91% sand at Station B2, downcoast of the river at a depth of 12 ft (Table 4). At the San Gabriel River stations (B10, B11, and B12), sediments ranged from almost 72% to more than 91% sand (Table 5). The proportion of silt in the offshore stations ranged from 7% at Station B2 to 36% at Station B7. Sediments at the river stations ranged from 6 to 21% silt. Clay fractions at the offshore stations ranged from 1.7% at Station B2 and Station B6 (upcoast of the river on the 12 ft isobath) to 14.4% at Station B7.

Sediments at the river stations ranged from 2.4% to 7.3% clay. Gravel was not present at any of the stations.

Table 5. Sediment grain size parameters, Stations B10 - B12. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Parameter	River			Mean	S.D.
	B10	B11	B12		
% Gravel	0.0	0.0	0.0	0.0	0.0
% Sand	71.73	77.13	91.48	80.1	10.2
% Silt	20.98	16.79	6.11	14.6	7.7
% Clay	7.29	6.08	2.41	5.3	2.5
Mean grain size					
phi	3.14	2.37	1.15	1.99	1.00
μm	113	193	449	252	175.5
Sorting (ϕ)	2.29	2.59	1.27	2.05	0.69
Skewness	0.70	0.42	0.35	0.49	0.19
Kurtosis	1.02	1.11	2.77	1.63	0.99

Mean grain size for the offshore study area averaged 3.26 phi (approximately 104 μm , on the fine end of the very fine sand category) and ranged from 2.55 phi (171 μm , fine sand) at Station B8 to 4.43 phi (47 μm , coarse silt) at Station B7 (Table 4). Mean grain size at the river stations ranged from 1.15 phi (approximately 449 μm , on the coarse end of the medium sand category) at Station B12 to 3.14 phi (113 μm , on the fine end of the very fine sand category) at Station B10. Sediments were similar among Stations B1, B2, B3, and B4. Those at Station B6 were slightly coarser, while those at Stations B5 and B9 were finer. Finest sediments occurred at Station B7, while coarsest sediments occurred at Station B8. Sediments in the river varied widely from fine to very coarse.

B3, and B4. Those at Station B6 were slightly coarser, while those at Stations B5 and B9 were finer. Finest sediments occurred at Station B7, while coarsest sediments occurred at Station B8. Sediments in the river varied widely from fine to very coarse.

Sorting is a measure of the spread of the particle distribution curve with well sorted samples being those that have few particle sizes and poorly sorted, those that have a preponderance of different particle sizes. In 2001, sorting at offshore stations averaged 1.16 phi (poorly sorted) (Table 4). Sorting values offshore ranged from 0.67 phi (moderately well sorted) at Station B2 to 2.69 phi (very poorly sorted) at Station B7. Sediments at Station B2 were composed of 91% sand, with very small amounts of silt and clay. At Station B7, sediments were primarily sand (50%), followed by moderate amounts of silt (36%) and clay (14%). At Stations B10, B11, and B12 in the river sorting ranged from 1.27 phi (poorly sorted) to 2.59 phi (very poorly sorted).

Skewness and kurtosis tell how closely the grain size distribution curve approaches the normal Gaussian probability curve. More extreme skewness and kurtosis values indicate non-normal distributions. Skewness is a measure of the symmetry of the particle distribution curve; a value of zero indicates a symmetrical distribution of fine and coarse materials around the mode of the curve, while a value greater than zero (positive) indicates an excess of fine material, and a negative value indicates an excess of coarse material.

Sediments offshore (except for two stations) were positively skewed, indicating excess fine material (a tail at the fine end of the distribution curve) (Table 4). Sediments at Stations B1, B5, and B8 were the most skewed (values 0.25 or greater), indicating a less symmetrical distribution. Sediments at Stations B3 and B6 were negatively skewed, indicating excess coarse sediments; they were the most strongly negatively skewed of any of the offshore stations. The three river stations ranged from 0.35 to 0.70 and averaged 0.49, all positively skewed.

Kurtosis in offshore sediments, the measure of peakedness of the particle distribution curve, averaged 1.51, and ranged from 0.83 at Station B7 to 1.99 at Station B1, just offshore of the San Gabriel River (Table 4). Values greater than 1.0 indicate distributions that are leptokurtic, or excessively peaked, with better sorting in the central portion of the curve than in the tails. Kurtosis values less than 1.0, indicating a platykurtic (flat-peaked) distribution, were recorded only at Station B7. All three of the river station values were greater than 1.0, ranging from 1.02 at Station B10 to 2.77 at Station B12.

Sediment Chemistry

Concentrations of metals detected in sediments at each station are presented in Appendix E and are summarized in Table 6. The highest or almost highest concentrations of chromium, copper, nickel, and zinc in the study area were found at Station B7, upcoast and offshore of the mouth of the San Gabriel River. Lowest or almost lowest concentrations of all metals were at Station B2, located downcoast along the 12-ft isobath. Metal concentrations were two to three times higher at Station B7 than at Station B2. In the river, chromium, copper, and nickel concentrations were highest at Station B11 downstream of the generating stations, while zinc was greatest at Station B10, the furthest upriver station. Lowest concentrations in the river stations were found at Station B12 near the mouth of the river. There was no obvious correlation with depth for any of the parameters with concentrations high and intermediate at deep stations, low or intermediate at shallow stations, and intermediate, low, or high at intermediate depth stations within the sampling area.

Table 6. Sediment metal concentrations (mg/dry kg). Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Metal	Upcoast			River Mouth Area			Downcoast			River			Survey		Effects Range (low)	Detection Level
	B6	B3	B7	B1	B4	B8	B2	B5	B9	B10	B11	B12	Mean	S.D.		
Chromium	12	13	29	11	18	13	8.8	12	13	8.4	11	7.1	13.0	5.8	81	1.3 - 1.8
Copper	8.7	8.5	24	12	19	6.1	6.3	8.7	7.6	18	25	15	13.2	6.9	34	1.3 - 1.8
Nickel	9.2	8.8	16	9.6	13	7.1	6.2	8.4	7.8	7.8	8.4	5.9	9.0	2.9	21	1.3 - 1.8
Zinc	42	40	82	51	72	34	31	40	35	79	52	36	49.5	18.5	150	6.5 - 9.1

MUSSEL BIOACCUMULATION

In 2001, forty-five (45) bay mussels (*Mytilus edulis*) each were collected from the riprap in the San Gabriel River downstream from and as close as possible to the Haynes and Alamitos L.L.C. generating stations' discharge structures. The mussels were analyzed for bioaccumulation of the metals chromium, copper, nickel, and zinc.

Table 7. Bay mussel tissue metal concentrations (mg/dry kg). Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Metal	Replicate			Mean	S.D.	Effects Range (low)	Detection Limit
	1	2	3				
Discharge (river mouth)							
Chromium	ND	ND	ND	ND	-	81	5.9 - 7.7
Copper	12	7.7	12	10.6	2.5	34	5.9 - 7.7
Nickel	ND	ND	ND	ND	-	21	5.9 - 7.7
Zinc	190	110	210	170	52.9	150	30 - 39
Pier Reference Site (Newport Beach bell buoy)							
Chromium	ND			ND	-	81	8.7
Copper	11			11	-	34	8.7
Nickel	ND			ND	-	21	8.7
Zinc	150			150	-	150	43.0
Catalina (west end) Reference Site							
Chromium	ND	ND	ND	ND	-	81	7.4 - 9.5
Copper	13	16	16	15	1.7	34	7.4 - 9.5
Nickel	ND	ND	ND	ND	-	21	7.4 - 9.5
Zinc	270	170	250	230	52.9	150	28 - 47

ND = Below the detection limit (for calculations ND = 0)

Copper and zinc were detected in all three replicates, while concentrations of chromium and nickel were below detection levels in all replicates (Table 7 and Appendix F). Mean concentration of copper was 10.6 mg/dry kg and mean concentration of zinc was 170 mg/dry kg.

BIOLOGICAL MONITORING

Benthic Infauna

Infauna data are presented by station and replicate in Appendix G, and are summarized in the following text.

A total of 25,151 individuals representing 261 species in 13 phyla were collected in the infauna sampling at the 12 benthic stations in summer 2001 (Table 8). Arthropods were the most abundant phylum with 20,940 individuals in 66 species, accounting for 25% of the species and 83% of the individuals. Annelids (with 120 species) and mollusks (41 species) were the next most diverse phyla, with 46% and 16% of the species and 14% and 1% of the individuals, respectively. Four phyla, Brachiopoda, Ectoprocta, Phorona, and Sipuncula, were represented by only one species and Sipuncula by one individual. Nine of the benthic stations were located offshore of the receiving waters of the San Gabriel River and the other three were located at varying distances upstream in the river. As they are two distinct habitats, they are reported separately herein.

Species Richness. Offshore of the river, number of species, or taxa, totaled 216 species and averaged 57.6 species per station and ranged from 45 species at Station B4, at the mouth of the river, to 76 species at Station B7, the deepest station directly upcoast of the river mouth (Table 9). On average, there were more species upcoast of the river mouth (61 species per station) than either at the river mouth (55 species per station) or downcoast (57 species per station). The least number of species were noted in the river (mean of 32 species per station). The number of

Table 8. Number of infauna species and individuals by phylum. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Phylum	Upcoast			River Mouth Area			Downcoast			Offshore Subtotal	San Gabriel River			River Subtotal	Overall Total	Percent Total
	B6	B3	B7	B1	B4	B8	B2	B5	B9		B10	B11	B12			
Number of species																
Annelida	19	27	45	21	20	37	15	27	38	101	6	22	15	27	120	46.0
Arthropoda	15	13	12	14	12	13	19	17	9	54	2	14	12	17	66	25.3
Mollusca	5	8	11	12	10	5	5	8	8	32	1	4	7	10	41	15.7
Nemertea	4	6	1	1	2	3	1	2	6	9	-	4	2	5	11	4.2
Cnidaria	2	-	1	1	-	2	1	2	1	5	-	2	1	2	6	2.3
Echinodermata	-	3	3	1	-	1	1	1	-	5	-	-	-	0	5	1.9
Nematoda	-	1	-	-	-	1	-	-	1	1	-	-	1	1	3	1.1
Platyhelminthes	-	-	-	-	-	1	-	-	-	1	-	1	2	2	3	1.1
Chordata	1	1	-	1	1	1	1	-	1	2	-	-	-	0	2	0.8
Brachiopoda	-	-	1	-	-	-	-	-	1	1	-	-	-	0	1	0.4
Ectoprocta	-	-	-	1	-	-	-	1	-	1	-	-	-	0	1	0.4
Phorona	1	1	2	2	-	1	2	1	1	3	-	-	1	1	1	0.4
Sipuncula	-	-	-	-	-	1	-	-	1	-	-	-	-	0	1	0.4
TOTAL	47	60	76	54	45	65	46	59	66	216	9	47	41	65	261	
Number of individuals																
Arthropoda	65	33	48	58	55	19	31	67	25	401	101	8845	11593	20539	20940	83.3
Annelida	176	173	278	372	151	165	246	253	198	2012	401	443	777	1621	3633	14.4
Mollusca	21	15	20	25	26	8	11	22	12	160	1	47	31	79	239	1.0
Cnidaria	3	-	1	2	-	9	9	6	6	36	-	9	131	140	176	0.7
Nemertea	6	7	3	1	5	7	1	2	10	42	-	6	2	8	50	0.2
Platyhelminthes	-	-	-	-	-	1	-	-	-	1	-	39	2	41	42	0.2
Phorona	4	1	3	7	-	6	2	4	2	29	-	-	1	1	30	0.1
Chordata	1	1	-	2	4	2	6	-	1	17	-	-	-	-	17	0.1
Echinodermata	-	5	3	1	-	1	1	1	-	12	-	-	-	-	12	<0.1
Nematoda	-	2	-	-	2	-	-	-	2	6	-	-	1	1	7	<0.1
Brachiopoda	-	-	1	-	-	-	-	-	1	2	-	-	-	-	2	<0.1
Ectoprocta	-	-	-	1	-	-	-	1	-	2	-	-	-	-	2	<0.1
Sipuncula	-	-	-	-	-	-	1	-	-	1	-	-	-	-	1	<0.1
TOTAL	276	237	357	469	241	220	308	356	257	2721	503	9389	12538	22430	25151	

Table 9. Infaunal community parameters. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Parameter	Upcoast			River Mouth Area			Downcoast			Offshore Subtotals	San Gabriel River			River Subtotals	Overall Total	Station Mean
	B6	B3	B7	B1	B4	B8	B2	B5	B9		B10	B11	B12			
Number of species																
Total	47	60	76	54	45	65	46	59	66	216	9	47	41	65	261	51
Mean	23.0	26.0	35.0	27.0	21.5	28.0	19.5	27.8	32.3		5.0	29.0	26.3			25.0
S.D.	1.2	10.2	3.6	5.9	5.4	3.4	4.7	6.6	6.8		0.0	4.2	2.5			
Number of individuals																
Total	276	237	357	469	241	220	308	356	257	2721	503	9389	12538	22430	25151	2096
Mean	69.0	59.3	89.3	117.3	60.3	55.0	77.0	89.0	64.3		125.8	2347.3	3134.5			524.0
S.D.	10.6	26.5	20.5	38.9	16.3	13.0	31.1	26.2	24.1		66.1	225.9	242.5			
Density										(7,558/m ²)			(186,917/m ²)		(52,398/m ²)	
Diversity (H')																
Total	2.88	3.15	3.28	2.67	3.02	3.52	2.29	3.03	3.59	3.90	0.78	1.02	1.07	1.13	1.76	2.52
Mean	2.56	2.61	2.93	2.42	2.62	2.81	2.12	2.62	2.70		0.23	0.52	0.57			2.06
S.D.	0.24	0.41	0.24	0.31	0.25	0.19	0.50	0.41	0.26		0.06	0.05	0.09			
Biomass (g)																
Total	4.13	3.09	2.25	3.60	0.97	2.19	8.77	5.78	1.72	32.51	0.45	4.07	5.75	10.27	42.78	3.56
Mean	1.03	0.77	0.56	0.90	0.24	0.55	2.19	1.45	0.43		0.11	1.02	1.44			0.89
S.D.	1.00	0.36	0.17	0.41	0.09	0.22	0.22	1.00	0.13		0.10	0.21	0.34			(89 g/m ²)

species increased with water depth (an average of 49 species per station nearshore compared with 55 species at the mid-depth stations and 69 species furthest offshore). In the river, number of species ranged from 9 to 47 per station and totaled 65 species.

Abundance. Abundance offshore totaled 2,721 individuals and averaged 302 per station and ranged from 220 individuals at Station B8 to 469 individuals at Station B1 (Table 9). On average, station abundance was greater off the river mouth (with a mean of 310 individuals); upcoast and downcoast, abundances were less, with means of 290 and 307 individuals, respectively. Abundance was also greatest on average at the shallow stations (351 individuals per station), although abundance at that depth varied widely by station. Average abundance was the same at the mid-depth and the offshore stations (278 individuals per station). Density averaged 7,558 individuals/m² for the offshore study area. In the river, abundance totaled 22,430 individuals and averaged 7,477 individuals per station decreasing upriver, from 503 at Station B10 to 12,538 at Station B12. Density in the river averaged almost 187,000 individuals/m².

Species Diversity. Shannon-Wiener total species diversity (H') was 3.90, but mean diversity was 3.05 for the offshore study area, and ranged from 2.29 at Station B2 to 3.59 at Station B9 (Table 9). Values were similar at the upcoast, river mouth, and downcoast areas; they were also lowest nearshore and increased with water depth. In the San Gabriel River, total diversity was 1.13, but mean diversity was 0.96 ranging from 0.78 at the furthest station upriver and increasing downriver to 1.07 at Station B12.

Biomass. Wet-weight biomass of infaunal organisms at offshore stations averaged 3.61 g per station (90 g/m²), and ranged from 0.97 g at Station B4 to 8.77 g at Station B2 (Table 9). Biomass did not correlate well with abundance, because frequently a few large individuals provide most of the biomass. Overall, the highly abundant annelids contributed to more than half of the total biomass. In the river, biomass totaled 10.27 g and ranged from 0.45 g at Station B10 to 5.75 g at Station B12. Arthropods were most abundant and amassed the most weight (Appendix G-4).

Community Composition. The 22 most abundant species, those that each comprised 0.2% or more of the total abundance (Table 10). Together they accounted for almost 94% of the

Table 10. The 22 most abundant infaunal species. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Phylum Species	Upcoast			River Mouth Area			Downcoast			Offshore			San Gabriel River			Overall Total
	B6	B3	B7	B1	B4	B8	B2	B5	B9	Subtotal	B10	B11	B12			
AR <i>Monocorophium acherusicum</i>	3	2	-	7	1	1	-	4	-	18	7	7105	9246			16376
AR <i>Ericthonius brasiliensis</i>	1	4	-	-	-	-	1	-	-	6	-	1213	1587			2806
AR <i>Grandidierella japonica</i>	-	-	-	-	-	-	1	-	-	1	94	314	523			932
AN <i>Streblospio benedicti</i>	-	-	-	-	-	-	-	-	-	380	10	240				630
AN <i>Mediomastus acutus</i>	38	58	1	108	44	13	22	44	8	336	-	-	-			336
AN <i>Owenia collaris</i>	77	-	-	15	-	3	149	92	-	336	-	-	-			336
AN <i>Streblosoma</i> sp B SCAMIT 1985	-	-	-	-	-	-	-	-	-	-	-	115	210			325
AN <i>Mediomastus</i> spp	3	41	23	129	30	19	13	10	42	310	-	-	-			310
AN <i>Capitella capitata</i> Cmplx	-	-	-	-	-	-	-	-	-	-	6	86	129			221
AR <i>Elasmopus bampo</i>	-	-	-	-	-	-	-	-	-	-	83	130				213
AN <i>Cirriformia</i> sp	1	-	-	-	-	-	-	-	-	1	-	62	107			170
AN <i>Apopriionospio pygmaea</i>	24	11	1	25	28	16	19	24	17	165	-	-	-			165
CN Actiniaria	1	-	-	-	-	-	-	-	-	1	-	4	131			136
AN <i>Sphaerosyllis californiensis</i>	-	-	-	-	-	-	-	-	-	-	-	72	48			120
AN <i>Cossura</i> sp A Phillips 1987	-	-	101	-	-	1	-	-	1	103	-	-	-			103
AR <i>Diestylopsis tenuis</i>	19	-	-	15	20	-	7	26	-	87	-	-	-			87
AR <i>Paranthuria elegans</i>	-	-	-	1	-	-	-	-	-	1	-	59	15			75
AR <i>Paracerceis sculpta</i>	-	-	-	1	-	-	-	-	-	1	-	24	37			62
AR <i>Podocerus fulanus</i>	-	-	-	-	-	-	-	-	-	-	-	19	38			57
AN <i>Goniada littorea</i>	3	1	-	19	14	-	2	12	3	54	-	-	-			54
AN <i>Spiophanes bombyx</i>	-	5	-	1	4	28	9	5	-	52	-	-	-			52
AN <i>Spiophanes duplex</i>	2	8	1	3	-	13	22	-	2	51	-	-	-			51

Key: AN = Annelida, AR = Arthropoda, CN = Cnidaria

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individuals in the infaunal community, even though they were only 8% of the species. Of these 22 species, 13 were annelid worms, eight were arthropods, and one was a cnidarian. None of these species occurred at all 12 stations. Of the 22 species, 13 were abundant in the river and nine were abundant offshore. The most abundant species in the offshore area was *Owenia collaris*, a small tube-dwelling polychaete worm which were particularly abundant in the nearshore and mid-depth offshore areas. Of the other species abundant in the offshore area, only three were present at all nine offshore stations. They were the polychaete annelids *Mediomastus acutus*, unidentified cogeners *Mediomastus spp.*, and *Apoprionospio pygmaea*. One species, the ostracod *Cossura* sp. A Phillips 1987, occurred at three stations, but only at one in abundance (Station B7). The cumacean *Diastylopsis tenuis* was the most abundant arthropod, with just over 3% of the individuals in the offshore area. The composition at Station B1 differed somewhat from that at the other stations: the two *Mediomastus* taxa were highly abundant at Station B1. Generally, the top species were more abundant at the river mouth and downcoast, and less abundant upcoast and offshore. The top species in abundance in the river were the arthropods *Monocorophium acherusicum* (comprising more than 65% of the individuals collected in the study area), *Ericthonius brasiliensis*, and *Grandidierella japonica*, the latter two comprising 11.2% and 3.7% of the total abundance. Also abundant was the annelid *Streblospio benedicti* which was found only in the river and in abundance at Stations B10 and B12. The small cnidarian anemone *Actiniaria* was also very abundant especially at the two stations downstream of the discharges of the generating stations.

Cluster Analysis. The 22 most abundant species were used in the infaunal classification analyses. Normal (site-group) cluster analysis resulted in three groups of stations based on their infaunal composition (Figure 11). Group I included all of the offshore stations which were

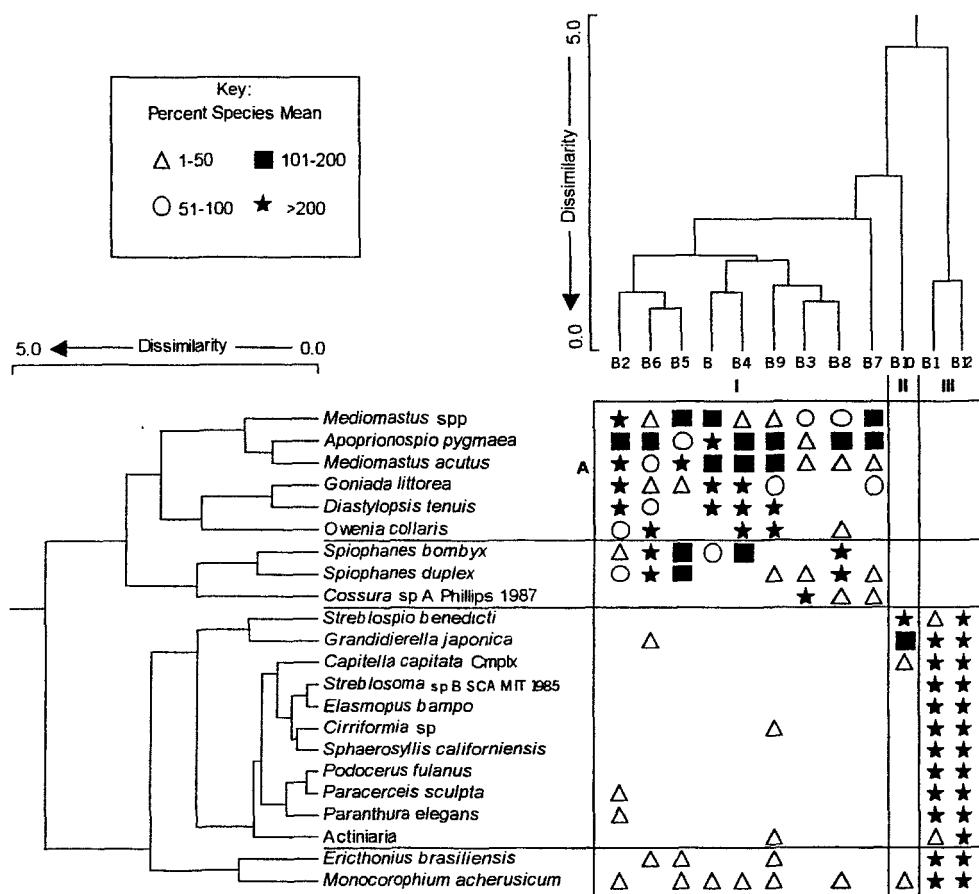


Figure 11. Two-way coincidence table resulting from normal (station) and inverse (species) classification dendrograms for the 22 most abundant infaunal species. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

subgrouped with the river mouth stations (B1 and B4) grouped together, the nearshore Stations B2, B6, and B5 grouped together, and two of the offshore and one mid-depth station together; Station B7 was by itself in a subgroup because of low occurrence of dominants and the high abundance of one of the dominants. Group II included only Station B10, the station in the river upstream of the generating stations discharges because of the low occurrence of the dominant species in the river. Group III included the other two river stations.

Inverse (species-group) analysis formed four major species groups (Figure 11). Species Group A is composed of the species that were most abundant overall and occurred throughout the offshore stations. Group B is composed of species with high abundance but only occurring at a few of the stations in the offshore study area, while Group C includes those abundant species which were found almost exclusively in the river. Group D contains two species that were found in abundance in the river, but also occurred at several stations in the offshore area.

Fish and Macroinvertebrates

The results of the otter trawl surveys are presented by station and replicate in Appendix H and summarized separately in tables and figures for fish and macroinvertebrates.

Fish - Trawls

Species Composition. Twenty-seven fish species representing two classes and 15 families were collected during the 2001 trawl surveys (Appendix H-1). These included 25 species of bony fishes and two cartilaginous species. The most diverse families, with at least three species each, were the Embiotocidae (surfperches), the Pleuronectidae (right-eyed flounders), and the Sciaenidae (croakers).

Four species occurred at three or more stations in both winter and summer: white croaker (*Genyonemus lineatus*), speckled sanddab (*Citharichthys stigmaeus*), California halibut (*Paralichthys californicus*) and California lizardfish (*Synodus lucioceps*) (Table 11). California halibut occurred at all six stations during both sampling seasons. The only other species to occur at all six stations was white croaker, and only in the winter survey.

In the winter survey, several species were captured exclusively at the nearshore or offshore stations. Bat ray (*Myliobatis californica*), deepbody anchovy (*Anchoa compressa*), and walleye surfperch (*Hyperprosopon agenteum*) were only caught at the nearshore stations (Table 11). Black perch (*Embiotoca jacksoni*), bay goby (*Lepidogobius lepidus*), hornyhead turbot (*Pleuronichthys verticalis*), California tonguefish (*Syphurus atricauda*), and shiner perch (*Cymatogaster aggregata*) were only captured at the offshore stations. In summer, diamond turbot (*Hypsopsetta guttulata*) and Pacific staghorn sculpin (*Leptocottus armatus*) were the only species captured exclusively at the nearshore stations. Those fish that were caught exclusively at offshore stations in the summer survey were queenfish (*Seriphus politus*), northern anchovy (*Engraulis mordax*), white seaperch (*Phanerodon furcatus*), Pacific butterfish (*Peprilus simillimus*), shiner perch, bat ray, plainfin midshipman (*Porichthys notatus*), California scorpionfish (*Scorpaena guttata*) and California tonguefish.

Several species were taken exclusively in either the winter or the summer survey (Table 11, Appendices H-2 and H-3). Of the species with an abundance of two or more individuals, California corbina (*Menticirrhus undulatus*), kelp pipefish (*Syngnathus californiensis*), round stingray (*Urolophus halleri*), yellowfin croaker (*Umbrina roncador*), fantail sole (*Xystreurus liolepis*), black perch and bay goby were taken only in winter, Pacific butterfish and plainfin midshipman were the only species taken only in summer.

Table 11. Abundance and catch parameters for fish species taken by otter trawl. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Common Name	Winter						Summer						Grand Total		
	T1	T2	T3	T4	T5	T6	Total	T1	T2	T3	T4	T5	T6		
white croaker	1	158	102	11	38	58	368	2	-	1	28	-	-	31	399
speckled sanddab	13	12	4	40	18	16	103	-	-	2	4	2	3	11	114
queenfish	-	28	46	-	-	28	102	-	-	-	1	-	-	1	103
California lizardfish	-	-	-	-	-	-	-	-	3	17	4	4	12	40	40
California halibut	1	4	3	3	9	4	24	2	5	1	1	3	3	15	39
California tonguefish	-	-	-	31	1	-	32	-	-	-	6	-	-	6	38
spotted turbot	3	-	1	5	11	4	24	-	-	2	1	-	-	3	27
northern anchovy	-	5	10	1	-	-	16	-	-	-	7	-	-	7	23
white seaperch	-	-	1	4	1	-	6	-	-	-	7	2	-	9	15
Pacific butterfish	-	-	-	-	-	-	-	-	-	-	12	-	-	12	12
shiner perch	-	-	-	-	-	1	1	-	-	-	9	-	-	9	10
kelp pipefish	-	5	-	-	-	1	6	-	-	-	-	-	-	-	6
barred sand bass	-	-	1	-	2	-	3	-	1	-	-	-	1	2	5
diamond turbot	1	2	-	-	1	-	4	-	-	1	-	-	-	1	5
round stingray	-	-	4	1	-	-	5	-	-	-	-	-	-	-	5
California corbina	-	1	2	-	1	-	4	-	-	-	-	-	-	-	4
yellowfin croaker	-	-	3	-	-	1	4	-	-	-	-	-	-	-	4
fantail sole	-	-	2	1	1	-	4	-	-	-	-	-	-	-	4
black perch	-	-	-	1	-	1	2	-	-	-	-	-	-	-	2
bay goby	-	-	-	1	1	-	2	-	-	-	-	-	-	-	2
bat ray	-	1	-	-	-	-	1	-	-	-	1	-	-	1	2
plainfin midshipman	-	-	-	-	-	-	-	-	-	-	2	-	-	2	2
deepbody anchovy	-	-	1	-	-	-	1	-	-	-	-	-	-	-	1
walleye surfperch	-	-	1	-	-	-	1	-	-	-	-	-	-	-	1
hornyhead turbot	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1
Pacific staghorn sculpin	-	-	-	-	-	-	-	-	-	1	-	-	-	1	1
California scorpionfish	-	-	-	-	-	-	-	-	-	1	-	-	-	1	1
Station totals															
Number of individuals	19	216	181	100	84	114	714	4	9	25	84	11	19	152	866
Number of species	5	9	14	12	11	9	22	2	3	7	14	4	4	17	27
Diversity (H')	1.59	1.43	1.94	1.98	2.17	1.89	1.68	1.04	1.26	1.71	2.40	1.72	1.31	2.25	

Abundance. A total of 866 fish were taken in the trawl surveys of 2001 (Table 11). Total fish abundance was greater in winter (714 individuals) than in summer (152 individuals), with means of 119 and 25 individuals per station, respectively (Appendices H-2 and H-3). The number of fish per station varied considerably with the lowest, 4 individuals at Station T1, in summer, and the highest, 216 individuals at Station T2, in winter (Table 11). In winter, 30% of the abundance (216 individuals) was taken at nearshore Station T2. In summer, 56% of the abundance (84 individuals) was taken at offshore station T4.

In winter, white croaker (*Genyonemus lineatus*) accounted for 52% of the total abundance; speckled sanddab and queenfish each comprised 14% of the individuals collected (Appendix H-2). Together these three species accounted for 80% of the total. The remaining 19 species individually accounted for less than 5% of the total abundance. In the summer survey, California lizardfish and white croaker were the most abundant species, together representing 48% of the total catch (Appendix H-3). California halibut, Pacific butterfish, and speckled sanddab comprised 10%, 8%, and 7% respectively of the total, with the remaining 12 species individually accounting for less than 6% of the total.

Species Richness. Twenty-seven fish species were taken in the 2001 trawl surveys, ranging from 2 to 14 species at each station. The winter trawls yielded 22 species and in summer, 17 species were captured (Table 11). In winter, species richness was highest inshore and downcoast (Station T3), where 14 species were caught, and was lowest inshore and upcoast at Station T1,

where five species were captured. In summer, species richness was highest at Station T4 offshore and upcoast, with 14 species, and was lowest at Station T1, inshore and upcoast.

Diversity. During winter, the Shannon-Wiener diversity index (H') value was lowest inshore at the river mouth at Station T2 (1.43) and greatest offshore of the river mouth at Station T5 (2.17) (Table 11). Total diversity for winter was 1.68. In summer, the lowest value occurred inshore and upcoast at Station T1 (1.04), and the highest offshore and upcoast at Station T4 (2.40). Total diversity for summer was 2.25.

Biomass. A total of 44.0 kg of fish was taken in the 2001 otter trawls, winter and summer combined (Table 12). Total biomass was higher in winter (27.3 kg) ranging from 0.4 to 7.7 kg and averaging 4.5 kg per station (Appendix H-4). Winter biomass was highest at Station T5 where white croaker and California halibut were abundant, comprising 72% of the haul. Biomass was lowest at Station T1, which also had the lowest abundance. In summer, total biomass was 16.7 kg with a mean of 2.8 kg per station. Station biomass ranged from 0.2 kg at Station T1 to 8.2 kg at Station T4. Seventy-seven percent of the biomass at Station T4 was comprised of white croaker, bat ray, and white seaperch.

In winter, five species accounted for 80.8% of the total fish biomass (Appendix H-4). Those with the highest combined biomass were white croaker and California halibut comprising 31.5% and 23.9% of the total biomass, respectively. Five species accounted for 87.0% of the total fish biomass in the summer survey. Of these five, white croaker (37.6%) and California halibut (23.7%) contributed the greatest percentage to the total biomass.

Table 12. Biomass (kg) of fish species taken by otter trawl. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Size (length). Fish collected during both seasons ranged in length from less than 30 mm SL to 527 mm SL (Table 13, Appendices H-6 and H-7). The largest individuals captured in winter were a bat ray (480 mm DW), followed by a California halibut (448 mm SL), a California corbina (257 mm SL), a fantail sole (246 mm SL), and a kelp pipefish (242 mm SL). In the summer the largest individuals captured were a California halibut (527 mm SL), followed by a bat ray (484 mm DW), a barred sand bass (*Paralabrax nebulifer*) (233 mm SL), a California scorpionfish (229 mm SL), and a white croaker (226 mm SL). The smallest individuals (excluding fish less than 30 mm) were a white croaker (30 mm SL) in winter, and a speckled sanddab (36 mm SL) in summer.

White croaker, northern anchovy and queenfish less than 30 mm SL were not measured and therefore not included in the length analysis. In the winter survey, 289 white croaker and 23 northern anchovy under 30 mm SL were collected (Appendix H-6). In summer, 192 queenfish and 31 northern anchovy under 30 mm SL were collected (Appendix H-7).

Table 13. Standard length (mm) of fish species taken by otter trawl. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Common Name	Winter					Summer				
	Number	Min	Max	Mean	S.D.	Number	Min	Max	Mean	S.D.
deepbody anchovy	1	121	121	121	-	-	-	-	-	-
speckled sanddab	103	30	119	76.1	18.7	11	36	101	73.5	21.5
shiner perch	1	103	103	103	-	9	68	115	84.4	12.9
black perch	2	126	154	140	19.8	-	-	-	-	-
northern anchovy	16	31	62	42.9	10.0	7	54	64	57.9	3.1
white croaker	368	30	207	83.8	49.2	31	149	226	182.8	19.2
walleye surfperch	1	118	118	118	-	-	-	-	-	-
diamond turbot	4	176	202	185	11.9	1	193	193	193.0	-
bay goby	2	28	34	31	4.2	-	-	-	-	-
Pacific staghorn sculpin	-	-	-	-	-	1	145	145	145.0	-
California corbina	4	142	257	195	51.3	-	-	-	-	-
bat ray*	1	480	480	480	-	1	484	484	484.0	-
barred sand bass	3	169	217	198.7	25.9	2	161	233	197.0	50.9
California halibut	24	123	448	242.3	86.0	15	134	527	265.5	102.7
Pacific butterfish	-	-	-	-	-	12	95	123	111.5	8.4
white seaperch	6	128	187	156.3	28.1	9	144	200	172.8	20.6
spotted turbot	24	76	197	149.7	32.0	3	152	172	165.0	11.3
hornyhead turbot	1	120	120	120	-	-	-	-	-	-
plainfin midshipman	-	-	-	-	-	2	154	157	155.5	2.1
California scorpionfish	-	-	-	-	-	1	229	229	229.0	-
queenfish	102	49	167	122.5	33.9	1	153	153	153.0	-
California tonguefish	32	35	139	60.6	29.9	6	82	178	105.8	36.4
kelp pipefish	6	123	242	196.7	42.3	-	-	-	-	-
California lizardfish	-	-	-	-	-	40	123	210	166.1	21.1
yellowfin croaker	4	102	121	112.3	8.8	-	-	-	-	-
round stingray*	5	92	210	146	57.1	-	-	-	-	-
fantail sole	4	188	246	212.5	28.8	-	-	-	-	-

* Disc width used

Population Structure. A population structure analysis was performed on white croaker and California halibut. White croaker was the most abundant species, while California halibut had the highest overall biomass.

In winter, white croaker ranged in length from 30 to 207 mm SL (Table 13). Size distribution peaked at the 40 mm SL size class (Figure 12). White croaker abundance was considerably greater in the winter survey than the summer survey. In summer, white croaker ranged in length from 149 to 226 mm SL. Size distribution peaked at the 180 mm SL size class (Figure 12).

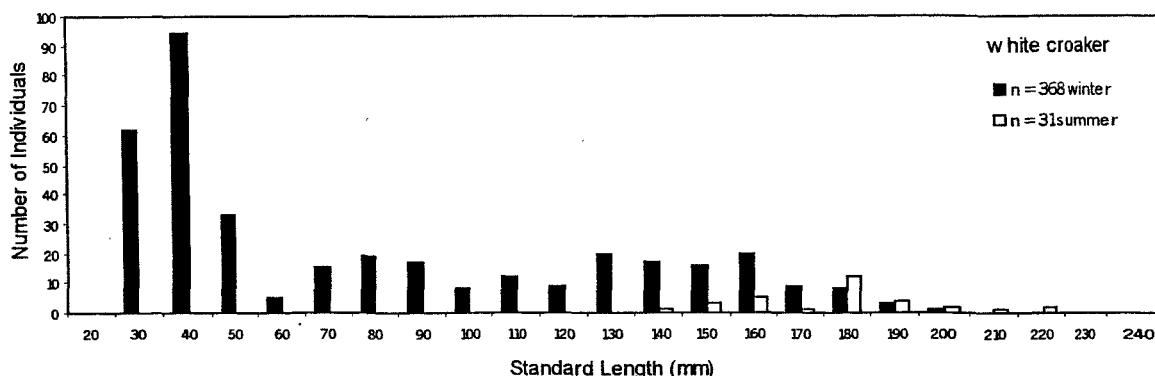


Figure 12. Length-frequency distribution of white croaker (*Genyonemus lineatus*) taken by otter trawl. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

The California halibut population in winter ranged in length from 123 to 448 mm SL with two modes, at 170 and 280 mm SL (Table 13, Figure 13). The summer population ranged in length from 134 to 527 mm SL with a mode at 290 mm SL.

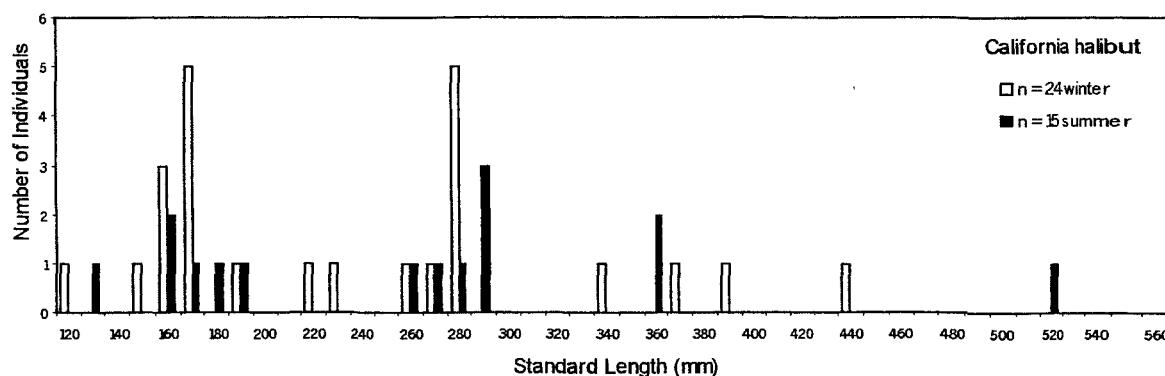


Figure 13. Length-frequency distribution of California halibut (*Paralichthys californicus*) taken by otter trawl. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Cluster Analyses. Classification analyses were performed separately for each season on the six stations and included all fish species. In winter, two station groups were delineated. Group I consisted of Station T6 (offshore and downcoast of the river mouth), and nearshore Stations T3 and T2 downcoast of and off the river mouth). Group II contained Station T1 (nearshore and upcoast of the river mouth), and offshore Stations T4 and T5 (upcoast of and at the river mouth) (Figure 14). In summer three groups were formed. Group I consisted of Station T4, an offshore station, Group II was composed of Stations T1, T2, and T5, one offshore and two nearshore stations, and Group III contained Station T6, an offshore station, and nearshore Station T3. (Figure 15).

Inverse cluster analyses (species-groups) resulted in the delineation of three species groups in winter and four in summer. In winter, Species Group A consisted of speckled sanddab, California halibut and spotted turbot, which were all collected at five or more of the stations in high abundance. (Figure 14). Group B consisted of 17 medium and lower ranking fish, containing barred sand bass, white seaperch, California tonguefish, bay goby, bat ray, hornyhead turbot, shiner perch, deepbody anchovy, northern anchovy, kelp pipefish, diamond turbot, California corbina, fantail sole, black perch, walleye surfperch, round stingray, and yellowfin croaker. Species Group C contained queenfish and white croaker and accounted for slightly more than 65% of the total catch.

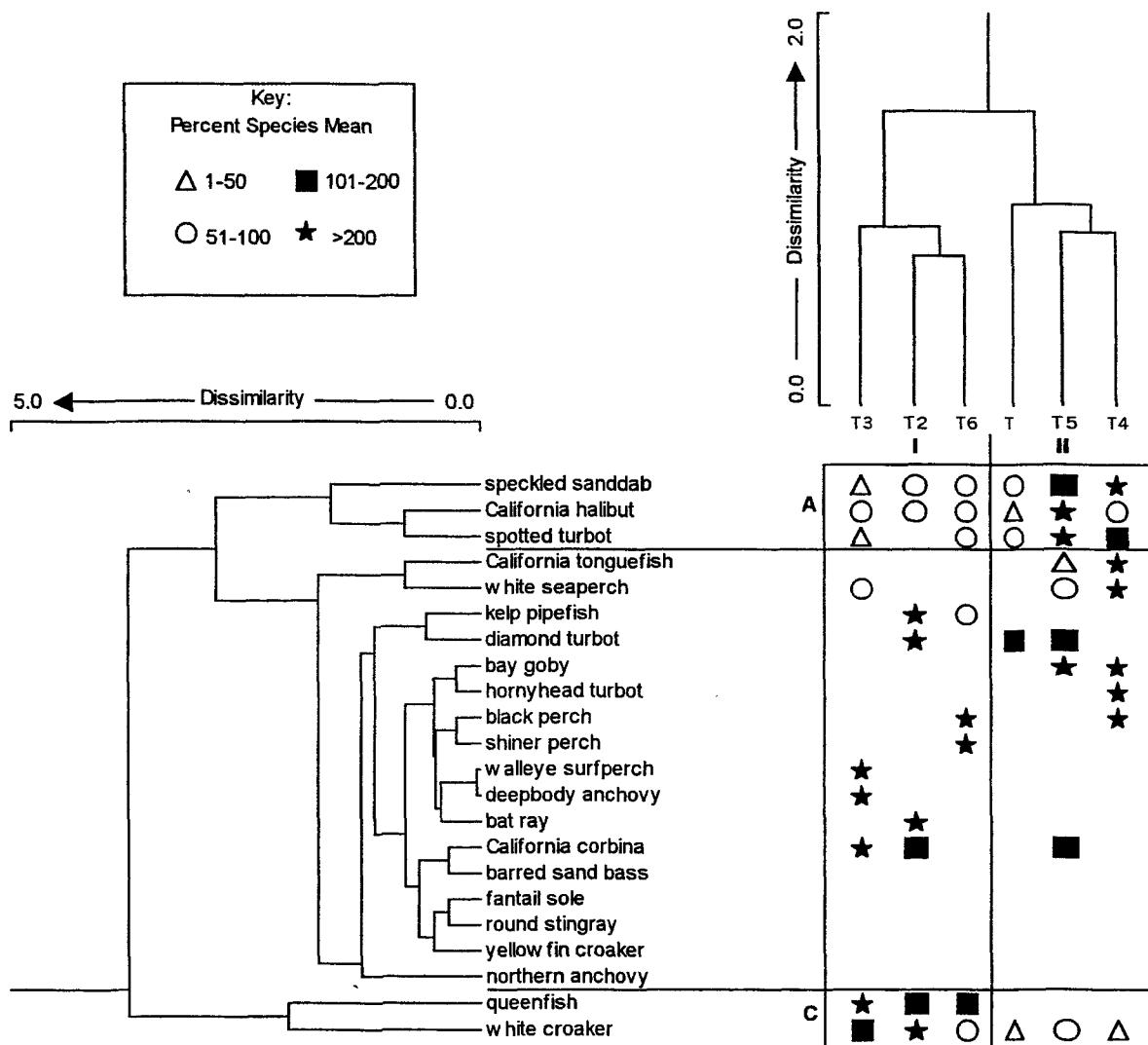


Figure 14. Two-way coincidence table resulting from normal (station) and inverse (species) classification dendrograms for fish taken by otter trawl, winter survey. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

In summer, Species Group A consisted of white croaker, the second most abundant species. Group B contained Pacific butterfish and shiner perch which were both found in medium abundance only at Station T4 (Figure 15). Group C contained 13 fish of the summer catch, including California halibut, northern anchovy, Pacific staghorn sculpin, bat ray, California scorpionfish, white seaperch, California tonguefish, diamond turbot, barred sand bass, plainfin midshipman, spotted turbot, speckled sanddab, and queenfish. California halibut was the fifth most abundant species in the summer survey, however this fish was only present in medium abundance, although at all six stations. Species Group D consisted of California lizardfish, the most abundant species.

Diseases and Abnormalities. In winter, three species were found to have abnormalities. Two individuals had damaged caudal fins, a California halibut and a fantail sole. A bat ray also had a missing spine (Appendix H-6). During the summer survey a parasitic isopod (*Lironeca vulgaris*) was found on a speckled sanddab (Appendix H-7).

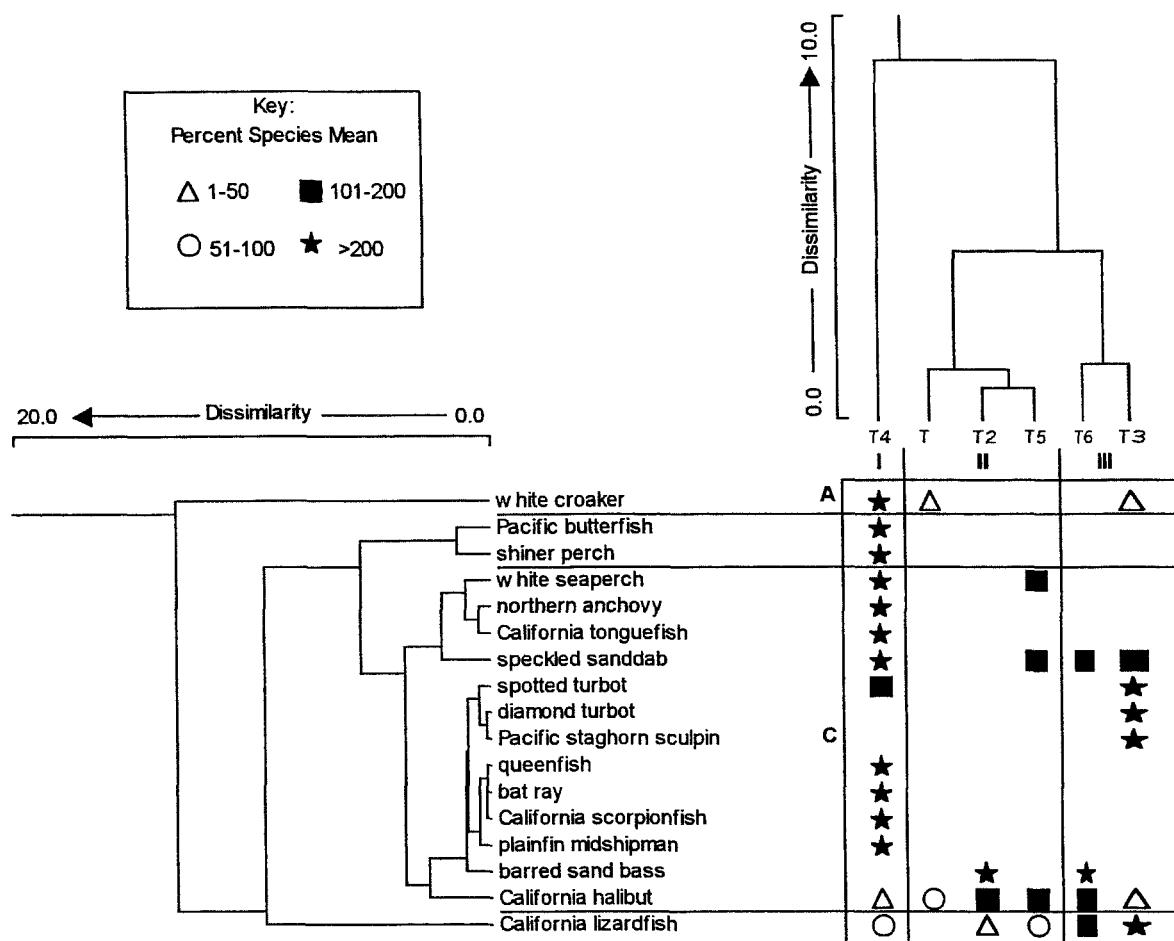


Figure 15. Two-way coincidence table resulting from normal (station) and inverse (species) classification dendrograms for fish taken by otter trawl, summer survey. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Macroinvertebrates - Trawls

In the 2001 trawl surveys, 25 invertebrate species were collected, 19 in winter and 10 in summer (Table 14). These included 13 arthropod, four echinoderm, seven mollusk, and one cnidarian species.

A total of 1,349 invertebrates was collected by otter trawl. The most abundant species (winter and summer combined) were blackspotted bay shrimp (*Crangon nigromaculata*) and tuberculate pear crab (*Pyromnia tuberculata*) which accounted for 52.0% and 33.1% of the total invertebrate abundance, respectively (Table 14). Abundance was much higher in winter than in summer. The winter survey was dominated by blackspotted bay shrimp (58% of the individuals) and tuberculate pear crab (28% of the individuals) (Table 14, Appendix H-8). In summer, tuberculate pear crab (72% of the individuals) was the most abundant species. Spiny sand star (*Astropecten armatus*) and blackspotted bay shrimp were the next most abundant representing 12% and 9% of the summer survey catch, respectively.

Four invertebrate species were found in both winter and summer: spiny sand star, tuberculate pear crab, blackspotted bay shrimp, and fat western nassa (*Nassarius perpinguis*) (Table 14). Spiny sand star was present at all stations in both winter and summer. Tuberculate pear crab

was found at four stations in winter and summer. Blackspotted bay shrimp was present at six stations in winter and five stations in summer.

In winter, two species were found only at the offshore stations; tortellini snail (*Philine suriformis*) and intertidal coastal shrimp (*Heptacarpus palpator*), while graceful rock (*Cancer gracilis*) crab was found only at nearshore stations (Table 14). In summer, masking crab (*Loxorhynchus crispatus*) was found only at offshore Station T6, while sea pansy (*Renilla kollikeri*) was found only at nearshore stations. Combining winter and summer, 70% of the invertebrates were captured at nearshore stations. Twenty-eight percent were found downcoast (Stations T3 and T6), 32% at the river mouth (Stations T2 and T5), and 40% upcoast (Stations T1 and T4).

Total invertebrate biomass for both surveys was 7.1 kg (Table 14). Collectively, short-spined sea star (*Pisaster brevispinus*), masking crab, and spiny sand star accounted for 75.4% of the total biomass (Appendices G-10 and G11). In winter, short-spined sea star and spiny sand star comprised 73% of the biomass. In summer, masking crab and spiny sand star accounted for 84.8% of the total biomass.

The total Shannon-Wiener diversity index (H') of invertebrates was 1.19 in winter and 1.03 in summer (Appendices G-8 and G-9), with station values ranging from 0.90 at Station T3 to 1.83 at Station T6, both in winter (Table 14). In summer, diversity was lowest at offshore and upcoast Station T4 and highest at offshore Station T5, off the river mouth.

Table 14. Abundance and catch parameters for macroinvertebrate species taken by otter trawl. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Common Name	Winter						Total	Summer						Grand Total		
	T1	T2	T3	T4	T5	T6		T1	T2	T3	T4	T5	T6			
blackspotted bay shrimp	22	221	221	129	53	43	689	1	2	3	5	2	-	13	702	
tuberculate pear crab	226	90	17	3	-	-	336	28	22	48	12	-	-	110	446	
spiny sand star	2	7	4	4	19	22	58	4	6	5	1	1	2	19	77	
tortellini snail	-	-	-	61	-	1	62	-	-	-	-	-	-	-	62	
intertidal coastal shrimp	-	-	-	20	-	-	20	-	-	-	-	-	-	-	20	
xantis swimming crab	1	2	1	1	2	6	13	-	-	-	-	-	-	-	13	
fat western nassa	-	-	1	-	1	1	3	-	-	1	-	-	-	-	1	4
graceful rock crab	1	1	1	-	-	-	3	-	-	-	-	-	-	-	3	
masking crab	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3	
moon snail hermit crab	-	-	-	-	-	-	-	-	-	-	-	1	1	2	2	
sea pansy	-	-	-	-	-	-	-	1	-	1	-	-	-	-	2	2
yellow crab	-	-	1	-	1	-	2	-	-	-	-	-	-	-	2	
California armina	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1	
California scorpionfish	1	-	-	-	-	-	1	-	-	-	-	-	-	-	1	
globose sand crab	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	
Hemphill fileclam	-	-	-	-	-	1	1	-	-	-	-	-	-	-	1	
hermit crab	-	-	-	-	-	1	1	-	-	-	-	-	-	-	1	
Orcutt nakedclam	-	-	-	-	-	1	1	-	-	-	-	-	-	-	1	
pubescent porcelain crab	-	-	-	-	-	1	1	-	-	-	-	-	-	-	1	
purple aeolis	-	-	-	-	1	-	1	-	-	-	-	-	-	-	1	
short-spined sea star	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1	
Southern moonsnail	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1	
spiny brittle star	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	
white sea urchin	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	
yellowleg shrimp	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1	
Station totals																
Number of individuals	253	321	246	222	77	77	1196	34	30	58	18	6	7	153	1349	
Number of species	6	5	7	10	6	9	19	4	3	5	3	5	4	10	25	
Diversity (H')	1.07	1.38	0.90	1.32	1.37	1.83	1.19	1.13	1.32	1.26	1.09	1.56	1.28	1.03		
Biomass (kg)	0.75	0.35	0.33	3.23	0.41	0.52	5.59	0.11	0.15	0.21	0.02	0.07	0.96	1.51		

Fish - Impingement

Results from heat treatment surveys of fish and macroinvertebrates entrained and impinged at the Haynes and AES Alamitos L.L.C. generating stations during the 2001 sampling year (1 October 2000 to 30 September 2001) are presented below. A master list of fish and invertebrate species is presented in Appendix I. Tables summarizing fish and macroinvertebrate data are presented in the following text. Fish and macroinvertebrate data are presented separately for each generating station.

Species Composition. In total, 20 species of fish, representing two classes and 12 families were taken during the 20 heat treatments at the two generating stations (Appendix I-1).

Haynes. Sixteen heat treatment surveys at Haynes Generating Station yielded 11 fish species, representing two classes and eight families (Table 15, Appendix I-2). One family of cartilaginous fish (Elasmobranchiomorpha = Chondrichthyes) and seven families of bony fish (Osteichthyes) were dominated by three species of anchovies (Engraulidae).

Table 15. Number of individuals and biomass (kg) of fish species impinged during heat treatments at Haynes Generating Station. Haynes and AES Alamitos L. L. C. generating stations NPDES, 2001.

Common Name	Abundance	Biomass	Percent		Cumulative Percent	
			Abundance	Biomass	Abundance	Biomass
queenfish	217	0.173	89.7	6.4	89.7	6.4
deepbody anchovy	6	0.023	2.5	0.9	92.1	7.2
specklefin midshipman	6	2.046	2.5	75.6	94.6	82.9
bay pipefish	3	0.005	1.2	0.2	95.9	83.1
slough anchovy	2	0.006	0.8	0.2	96.7	83.3
California grunion	2	0.007	0.8	0.3	97.5	83.5
round stingray	2	0.418	0.8	15.5	98.3	99.0
shiner perch	1	0.021	0.4	0.8	98.8	99.8
northern anchovy	1	0.001	0.4	0.0	99.2	99.8
giant kelpfish	1	0.003	0.4	0.1	99.6	99.9
white seaperch	1	0.002	0.4	0.1	100.0	100.0
Survey Totals	242	2.705				
Total Species	11					

Alamitos. Four heat treatment surveys at AES Alamitos L.L.C. generating station yielded 15 fish species, representing two classes and 10 families (Table 16, Appendix I-4). One family of cartilaginous fish and 10 families of bony fish were dominated by three species of croakers (Sciaenidae). No heat treatments were conducted at Units 1 and 2.

Abundance. In total, 376 individuals were taken during the 20 heat treatment surveys at the two generating stations.

Haynes. The heat treatment surveys at Haynes Generating Station yielded a total impingement of 242 individual fish (Table 17). The catch averaged 15.1 fish per heat treatment, and ranged from no fish at five surveys to 213 individuals at Unit 6 on 11 July 2001 (Appendix I-2). A heat treatment at Unit 6 had the most fish, 216 individuals, while Unit 4 yielded one individual (Table 17 and Appendix I-2).

The most abundant species at Haynes Generating Station was queenfish (*Seriphis politus*), which accounted for 89.7% (217 individuals) of all of the individuals taken in 2000 and 2001 (Table 15). The second and third most abundant species were deepbody anchovy (*Anchoa compressa*) and specklefin midshipman (*Porichthys myriaster*), each accounting for 2.5% of the individuals. The remaining eight species accounted for less than 6% of the total abundance.

Table 16. Number of individuals and biomass (kg) of fish species impinged during heat treatments at AES Alamitos L.L.C. generating station. Haynes and AES Alamitos L. L. C. generating stations NPDES, 2001.

Common Name	Abundance	Biomass	Percent		Cumulative Percent	
			Abundance	Biomass	Abundance	Biomass
queenfish	74	0.400	55.2	11.3	55.2	11.3
giant kelpfish	15	0.163	11.2	4.6	66.4	15.9
topsmelt	10	0.130	7.5	3.7	73.9	19.6
shiner perch	10	0.081	7.5	2.3	81.3	21.9
northern anchovy	5	0.025	3.7	0.7	85.1	22.6
plainfin midshipman	5	1.294	3.7	36.5	88.8	59.1
California halibut	4	0.323	3.0	9.1	91.8	68.2
jacksmelt	2	0.021	1.5	0.6	93.3	68.8
white croaker	2	0.109	1.5	3.1	94.8	71.9
specklefin midshipman	2	0.660	1.5	18.6	96.3	90.5
deepbody anchovy	1	0.014	0.7	0.4	97.0	90.9
black croaker	1	0.004	0.7	0.1	97.8	91.0
bat ray	1	0.224	0.7	6.3	98.5	97.3
Pacific sardine	1	0.049	0.7	1.4	99.3	98.7
white seaperch	1	0.045	0.7	1.3	100.0	100.0
Survey Totals	134	3.542				
Total Species	15					

Alamitos. The heat treatment surveys at AES Alamitos L.L.C. generating station yielded a total impingement of 134 individual fish (Table 18). The catch averaged 33.5 fish per heat treatment, and ranged from four fish at Unit 6 on 20 June 2001 to 78 individuals at Unit 5 on 31 August 2001 (Appendix I-4).

The most abundant species at AES Alamitos L.L.C. generating station was queenfish, which accounted for 55.2% (74 individuals) of all of the individuals taken in 2000 and 2001 (Table 16). The second most abundant species was giant kelpfish (*Heterostichus rostratus*), with 15 individuals and 11.2% of the abundance. Topsmelt (*Atherinops affinis*) and shiner perch (*Cymatogaster aggregata*) were tied for the third most abundant species, each accounting for 7.5% of the individuals. The remaining 11 species accounted for less than 19% of the total abundance.

Biomass. In total, 6.25 kg of fish biomass were taken during the 20 heat treatment surveys at the two generating stations.

Haynes. Fish biomass from the heat treatment surveys at Haynes Generating Station totaled 2.705 kg of fish, an average of 0.169 kg per survey (Table 17 and Appendix I-3).

Table 17. Number of species, number of individuals, and biomass (kg) of fish impinged during heat treatments at Haynes Generating Station. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Date	Number		
	Species	Individuals	Biomass
Unit 1			
18 Oct 00	2	3	0.003
12 Sep 01	4	9	0.704
Unit 2			
5 Dec 00	1	1	0.002
16 May 01	3	4	1.435
13 Jul 01	1	1	0.002
Unit 3			
20 Nov 00*	-	-	0.000
28 Mar 01*	-	-	0.000
15 May 01*	-	-	0.000
Unit 4			
22 Mar 01*	-	-	0.000
27 Sep 01	1	1	0.152
Unit 5			
20 Oct 00	2	3	0.012
27 Mar 01	1	1	0.003
12 Jun 01*	-	-	0.000
12 Jul 01	1	3	0.004
Unit 6			
1 Jun 01	3	3	0.027
11 Jul 01	6	213	0.361
Overall			
Total	11	242	2.705
Mean	2	15.1	0.169

*no fish were impinged.

Table 18. Number of species, number of individuals, and biomass (kg) of fish impinged during heat treatments at AES Alamitos LLC generating station. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Unit	Date	Number		
		Species	Individuals	Biomass
3 & 4	4 Mar 01	2	5	0.107
6	20 Jun 01	3	4	0.020
5	31 Aug 01	10	78	2.091
6	1 Sep 01	9	47	1.324
Overall				
Total		15	134	3.542
Mean		6	33.5	0.886

The five species with the greatest biomass were plainfin midshipman, specklefin midshipman, queenfish, California halibut, and bat ray, accounting for slightly under 82% of the total biomass (Table 16). Queenfish was also among the five most abundant species. Plainfin midshipman accounted for slightly more than 36% of the total biomass (Table 16). The remaining ten species contributed approximately 18% of the overall biomass.

Size (Length). Standard length (mm SL), total length (TL), or disc width (DW), where appropriate, were recorded in mm for the first 200 individuals taken per species during impingement surveys.

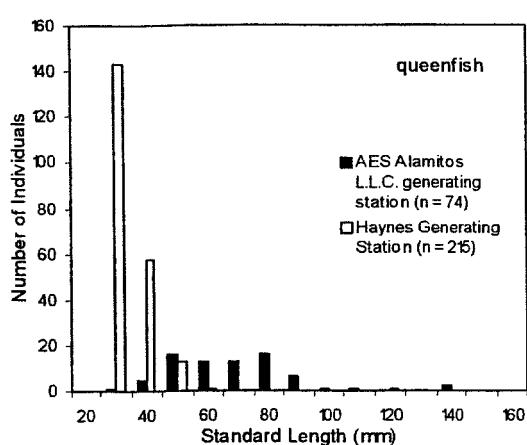


Figure 16. Length-frequency distribution of queenfish (*Seriphus politus*) impinged during heat treatments at Haynes and AES Alamitos L.L.C. generating stations. Haynes and AES Alamitos L. L. C. generating stations NPDES, 2001.

individuals and a biomass of 1.030 kg, were impinged during the heat treatment surveys at Haynes Generating Station (Table 19, Appendices I-6 and I-7). Comparing the six units surveyed, Unit 5 yielded the greatest abundance with 29 individuals, and Unit 6 yielded the highest biomass, 0.488 kg (Appendices I-6 and I-7). Mollusks were represented by nine species, arthropods (all crustaceans) by four species, and cnidarians and echinoderms by one species each.

The three species with the greatest biomass were specklefin midshipman, round stingray, and queenfish, accounting for slightly over 97% of the total biomass (Table 15). Two of these three species were also among the three most abundant species. Specklefin midshipman alone accounted for slightly more than 75% of the total biomass (Table 15). The remaining eight species contributed approximately 3% of the overall biomass.

Alamitos. Fish biomass from the heat treatment surveys at AES Alamitos L.L.C. generating station totaled 3.542 kg of fish, an average of 0.886 kg per survey (Table 18 and Appendix I-5).

The five species with the greatest biomass were plainfin midshipman, specklefin midshipman, queenfish, California halibut, and bat ray, accounting for slightly under 82% of the total biomass (Table 16). Queenfish was also among the five most abundant species. Plainfin midshipman accounted for slightly more than 36% of the total biomass (Table 16). The remaining ten species contributed approximately 18% of the overall biomass.

Population Structure. A length-frequency histogram was constructed for queenfish, the only species with sufficient abundance to construct a meaningful histogram (Figure 16). The queenfish population at Haynes Generating Station was unimodal, with a peak at 30 mm SL, and size ranging from 30 to 120 mm SL. At AES Alamitos L.L.C. generating station, queenfish population was bimodal, with peaks at 50 and 80 mm SL, with size ranging from 30 to 140 mm SL. This histogram does not necessarily reflect the composition of the population of Alamitos Bay.

Diseases and Abnormalities. No diseases or abnormalities were noted on any fish measured during the impingement surveys.

Macroinvertebrates - Impingement

Haynes. In total, 15 macroinvertebrate species representing four phyla and 11 families (Appendix I-1), with a total abundance of 74

Table 19. Number of individuals and biomass (kg) of macroinvertebrate species impinged during heat treatments at Haynes Generating Station. Haynes and AES Alamitos L. L. C. generating stations NPDES, 2001.

Common Name	Abundance	Biomass	Percent		Cumulative Percent	
			Abundance	Biomass	Abundance	Biomass
tuberculate pear crab	30	0.022	40.5	2.1	40.5	2.1
California two-spot octopus	13	0.770	17.6	74.8	58.1	76.9
spiny cup-and-saucer	6	0.006	8.1	0.6	66.2	77.5
Xantus swimming crab	4	0.097	5.4	9.4	71.6	86.9
Pacific purple urchin	4	0.054	5.4	5.2	77.0	92.1
striped sea hare	3	0.034	4.1	3.3	81.1	95.4
Pacific sea-lemon	2	0.013	2.7	1.3	83.8	96.7
onyx slippersnail	2	0.002	2.7	0.2	86.5	96.9
Pacific half-slippersnail	2	0.001	2.7	0.1	89.2	97.0
green glassy bubble snail	2	0.003	2.7	0.3	91.9	97.3
striped shore crab	2	0.004	2.7	0.4	94.6	97.7
two-spot keyhole limpet	1	0.003	1.4	0.3	95.9	98.0
California market squid	1	0.018	1.4	1.7	97.3	99.7
globose kelp crab	1	0.002	1.4	0.2	98.6	99.9
red jellyfish	1	0.001	1.4	0.1	100.0	100.0
Survey Totals	74	1.030				
Total Species	15					

Tuberculate pear crab (*Pyromnia tuberculata*) comprised over 40% of total invertebrate abundance, but only 2.1% of total biomass. California two-spot octopus (*Octopus bimaculoides*) accounted for 74.8% of total invertebrate biomass, and 17.6% of the abundance. Spiny cup-and-saucer (*Crucibulum spinosum*), Xantus swimming crab (*Portunus xantusi*), and Pacific purple urchin (*Strongylocentrotus purpuratus*) accounted for 8.1%, 5.4%, and 5.4%, respectively, of total invertebrate abundance, and 0.6%, 9.4%, and 5.2% of the biomass, respectively (Table 19). Together, these five species accounted for 77% of total invertebrate abundance and over 92% of total invertebrate biomass.

Alamitos. In total, nine macroinvertebrate species representing three phyla and eight families (Appendix I-1), with a total abundance of 244 individuals and a biomass of 1.811 kg, were impinged during the heat treatment surveys at AES Alamitos L.L.C. generating station (Table 20, Appendices I-8 and I-9). Comparing the units surveyed, Unit 5 yielded the most abundance with 139 individuals, as well as the highest biomass, 0.848 kg (Appendices I-8 and I-9). Arthropods (all crustaceans) and mollusks were represented by four species each, and echinoderms by one species.

Table 20. Number of individuals and biomass (kg) of macroinvertebrate species impinged during heat treatments at AES Alamitos Generating Station. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

common name	Abundance	Biomass	Percent		Cumulative Percent	
			Abundance	Biomass	Abundance	Biomass
yellow shore crab	128	0.183	52.5	10.1	52.5	10.1
tuberculate pear crab	100	0.135	41.0	7.5	93.4	17.6
California two-spot octopus	6	1.270	2.5	70.1	95.9	87.7
Pacific calico scallop	4	0.018	1.6	1.0	97.5	88.7
shield-backed kelp crab	2	0.049	0.8	2.7	98.4	91.4
California venus	1	0.008	0.4	0.4	98.8	91.8
California aglaja	1	0.007	0.4	0.4	99.2	92.2
warty sea cucumber	1	0.031	0.4	1.7	99.6	93.9
yellowleg shrimp	1	0.110	0.4	6.1	100.0	100.0
Survey Totals	244	1.811				
Total Species	9					

Yellow shore crab (*Hemigrapsus oregonensis*) comprised over 52% of total invertebrate abundance, and 10.1% of total biomass. California two-spot octopus accounted for 70.1% of total invertebrate biomass, and 2.5% of the abundance. Tuberculate pear crab accounted for 41% of total invertebrate abundance, and 7.5% of the biomass (Table 20). Together, these three species accounted for almost 96% of total invertebrate abundance and almost 88% of total invertebrate biomass.

DISCUSSION

WATER COLUMN MONITORING

Temperature

Past monitoring surveys have demonstrated that water temperature is the parameter most commonly affected by the effluent from the Haynes and AES Alamitos L.L.C. generating stations (EQA/MBC 1973, MBC 1979, 1981, 1986, 1988, 1990-2000a). In 2001, mean water temperatures in the San Gabriel River were approximately 6°C greater in winter and 5 to 8°C greater in summer than temperatures at offshore (San Pedro Bay) stations. The shallow depth of the river, which allows solar insolation, together with the input of warm water from the generating stations contribute to this temperature differential. As the warm river water approaches the river mouth, it mixes with and is eventually diluted by the waters of San Pedro Bay. Thermal effect studies of the Haynes and AES Alamitos L.L.C. generating stations discharges and NPDES surveys of previous years have shown that the thermal plume persists in San Pedro Bay as a lens of warm water in the top two meters of the water column (EQA/MBC 1973, MBC 1979, 1981, 1986, 1988, 1990-2000a). The extent of the warm water lens depends upon tidal cycle, wind speed and direction, wave height and energy, volume and temperature of the river effluent, and the natural thermal structure of the receiving waters.

During the winter survey, temperature differentials between tides at stations in the San Gabriel River were slight, with afternoon flood tide temperatures 1 to 2°C warmer than morning ebb tide temperatures (Figure 7). This is likely the result of solar insolation. Combined with waters warmed by solar insolation, the thermal discharge from the generating stations was noticeable as a warm water lens at nearshore stations RW1, RW2, RW4, and RW5, as indicated by warmer surface waters during both tides. Temperatures during the winter survey in 2001 were warmer than those recorded in 2000, but well within the range of previously recorded values in the study area (MBC 1979, 1981, 1986, 1988, 1990-2000a).

During the summer survey, temperatures at river stations were much higher than temperatures recorded at offshore stations. As the warmer water entered the bay, a warm water lens formed in the upper 1 m of the water at Stations RW1 and RW4. Temperatures in the lens were about 1 to 2°C warmer than ambient temperatures at other San Pedro Bay stations. Offshore Stations RW7, RW8, and RW9 appeared to be influenced by the tides, with slightly cooler temperatures throughout most of the water column during flood tide. Temperatures recorded during the 2001 summer survey were within the range of values previously recorded in the study area (MBC 1979, 1981, 1986, 1988, 1990-2000a).

Dissolved Oxygen

The DO concentration of seawater is affected by physical, chemical, and biological variables. High DO concentrations may be the result of cool water temperatures (solubility of oxygen in water increases as temperature decreases), active photosynthesis, and/or mixing at the air-water interface (Sverdrup et al. 1942). Conversely, low concentrations may result from high water temperatures, high rates of organic decomposition, and/or extensive mixing of surface waters with oxygen-poor subsurface waters.

Dissolved oxygen concentrations in winter at offshore stations were relatively high (and similar to values recorded in 1999 and 2000), while DO values at the three river stations were somewhat lower, corresponding to higher temperatures recorded there (MBC 1998-2000a). DO fluctuated with depth at all San Pedro Bay stations, generally with a maximum DO concentration at 4 to 6 m and then lower concentrations to the bottom. Oxygen concentrations during the survey were normal, indicating that productivity in the area was not affected by the warmer waters entering from the river. Higher DO concentrations were recorded at Stations RW3, RW6, and offshore Stations RW8, RW9, and RW10. Plankton blooms (red tides) were recorded at several of these stations. As the plankton thrive, they produce more oxygen than they consume, and can potentially create a supersaturated water mass as was noted at Station RW6 on flood tide. Lower DO concentrations throughout most of the San Gabriel River were probably caused by either higher water temperatures, high rates of organic decomposition (probable on bottom at Station RW10), and/or extensive mixing of surface waters with oxygen-poor subsurface waters typically found in shallow channels. High DO at RW10 on the surface during flood tide was probably caused by a plankton bloom. Dissolved oxygen concentrations were well within the range of values found in previous NPDES surveys (MBC 1979, 1981, 1986, 1988, 1990-2000a).

During the summer survey, DO concentrations were quite uniform throughout the water column at stations in San Pedro Bay indicating a well mixed water column. The slightly lower DO values in the upper 2 m at the river mouth on ebb tide correspond with higher water temperatures recorded there. In summer, DO concentrations upstream of the generating stations were lower than in winter, while values downstream of the generating stations were more similar to winter values. DO concentrations in 2001 were within the range of values recorded in previous monitoring surveys (MBC 1979, 1981, 1986, 1988, 1990-2000a).

Hydrogen Ion Concentration

In the open ocean, the hydrogen ion concentration (pH) remains fairly constant due to the buffering capacity of seawater (Sverdrup et al. 1942). However, in nearshore areas, pH may be more variable due to physical, chemical, and biological influences. For instance, in areas with a large organic influx, such as bays, estuaries, and river mouths, microbial decomposition increases. Along with a reduction in dissolved oxygen, decomposition also results in the production of humic acids, which decrease pH (Duxbury and Duxbury 1984). Reduced pH values may also occur in areas of freshwater influx, since freshwater usually has a lower pH than saltwater. In contrast, phytoplankton blooms (red tide), which are often associated with nearshore upwelling, may cause pH to increase. High photosynthetic rates increase the removal of carbon dioxide from water, thus reducing the carbonic acid concentration and raising pH.

In San Pedro Bay, hydrogen ion concentrations were slightly more variable at the inshore stations (Stations RW1-RW6) during the winter survey. At these stations, salinity readings indicated a lens of fresh water on the surface during both tidal cycles. Lower salinities were also probably responsible for slightly lower pH values recorded at these stations during both tides. Lower values at these stations were likely a result of fresh water mixing with the warmer water of the discharge.

During summer sampling, pH values at San Pedro Bay stations were nearly uniform throughout the water column with a slight fluctuation at Station RW4 corresponding to a fresher water lens on the surface. The lower values at Station RW10 were probably due to higher temperatures, fresh water, and biological influences typical of a shallow river. Hydrogen ion concentration is commonly lowest at Station RW10, the only station upriver of the generating stations. Lower pH values generally correspond to lower salinities at that station (MBC unpubl. data 1990-2000). Lower pH values in the upper two meters at Station RW1 off the river mouth indicates influence from river waters causing a slightly lower pH. All values were within ranges recorded in previous surveys (MBC 1979, 1981, 1986, 1988, 1990-2000a).

Salinity

Salinity in the open ocean is generally 35 parts per thousand (ppt); that is, a 1,000-g sample of ocean water contains 35 g of dissolved compounds, collectively referred to as salts (Sverdrup et al. 1942). In nearshore areas subjected to freshwater influx, however, salinity is usually slightly lower. In southern California, salinity of nearshore waters is generally between 33 and 34 ppt (Dailey et al. 1993). Reductions in nearshore salinity usually result from freshwater input, while slight increases are often associated with upwelling of colder, more saline bottom waters.

Salinity at the San Pedro Bay stations in winter was variable in the upper 2 to 4 m of the water column at nearshore stations within the influence of the San Gabriel River. At these stations, salinity readings indicated a lens of fresh water on the surface during both tidal cycles. Salinity at the stations upstream of the river mouth had highly variable salinities indicating a strong fresh water influence, especially at Station RW10 upstream of the generating stations.

In summer, salinity was nearly uniform throughout the water column on both tides at San Pedro Bay stations. Slight influences on salinity of less than 1 ppt by the river were noted at nearshore Stations RW1, RW3, and RW4. Again salinity was variable at Station RW10, but very little freshwater influence was noted at stations downstream of the generating stations.

SEDIMENT MONITORING

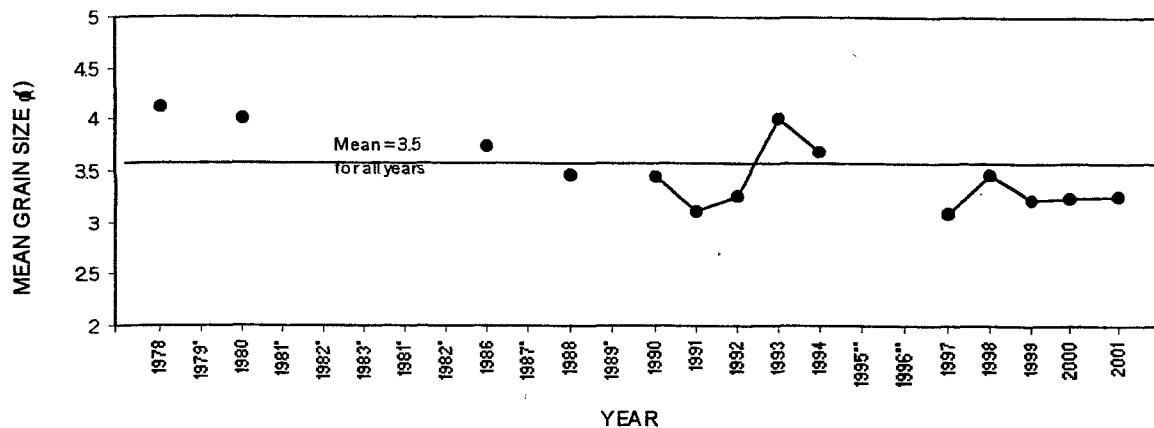
Sediment Grain Size

Sediment characteristics in 2001 varied somewhat among the stations. Sediments from the offshore study area were composed primarily of sand, with an average mean grain size in the very fine sand category. In general, sediments were coarse and well sorted nearshore due to turbulence from currents and swells which separates out finer particles and leaves coarser particles behind. However, in the study area, the nearshore zone is protected by the Anaheim Bay and Alamitos Bay breakwaters which reduce effects from swell and affect normal longshore drift. The Long Beach Breakwater provides some protection from swells at upcoast stations, as well, resulting in finer sediments (EQA/MBC 1973). Of the nine stations sampled this year offshore, sediments were finest at Station B7, upcoast on the 40-ft isobath. Coarsest sediments offshore occurred at Station B8, at a depth of 40 ft.

Sediment characteristics in 2001 were similar to those in previous surveys conducted from 1978 to 2001; average mean grain size through 2001 was 3.52 phi (Figure 17, MBC 1979, 1981, 1986, 1988, 1990-1994, 1997-2000a). During these surveys, mean grain size varied approximately one phi, from 4.11 (coarse silt) in 1978 to about 3.08 phi (very fine sand) in 1997. A majority of the fine to silty sediments sampled over the last 24 years probably have their source in the San Gabriel River. The yearly rainfall affects the amount of sediment washed down the river; annual sediment discharge into the marine environment by the San Gabriel River is estimated to be about 1,200,000 tons per year (Dailey et al. 1993). Prevailing currents may also affect the movement of finer sediments along the coast. The occurrence of coarser sediments has been more variable in the study area than for finer sediments. In the majority of surveys, the coarsest sediments occurred nearshore. However, coarse sediments have also occurred at intermediate depth and offshore. This year the coarsest sediments were found nearshore, at Station B6, and offshore at Station B8. The change in occurrence of coarse sediments (near, intermediate, or offshore) indicates the variable nature of the shallow subtidal marine environment, especially where obstructions complicate the movement of water and sediment.

Sediment characteristics and particle distribution appear to be influenced primarily by area-wide and localized climatological and oceanographic factors. Results of the 2001 survey do not

indicate that the discharges from the generating stations affect the sediments near the mouth of the San Gabriel River.



Note: * No data collected; ** Only four stations sampled.

Figure 17. Comparison of sediment mean grain size, 1978 - 2001. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Sediments at the three San Gabriel River stations displayed some similar and some different characteristics than those in the ocean study area. They were composed mostly of sand, with the mean grain size in the medium sand category. However, large proportions of silt and clay which increased with distance upriver may account for the majority of fine to silty sediments originating from the river. Spatial distribution of the finer particles depends on currents and climate, and the amount deposited depends on the yearly rainfall.

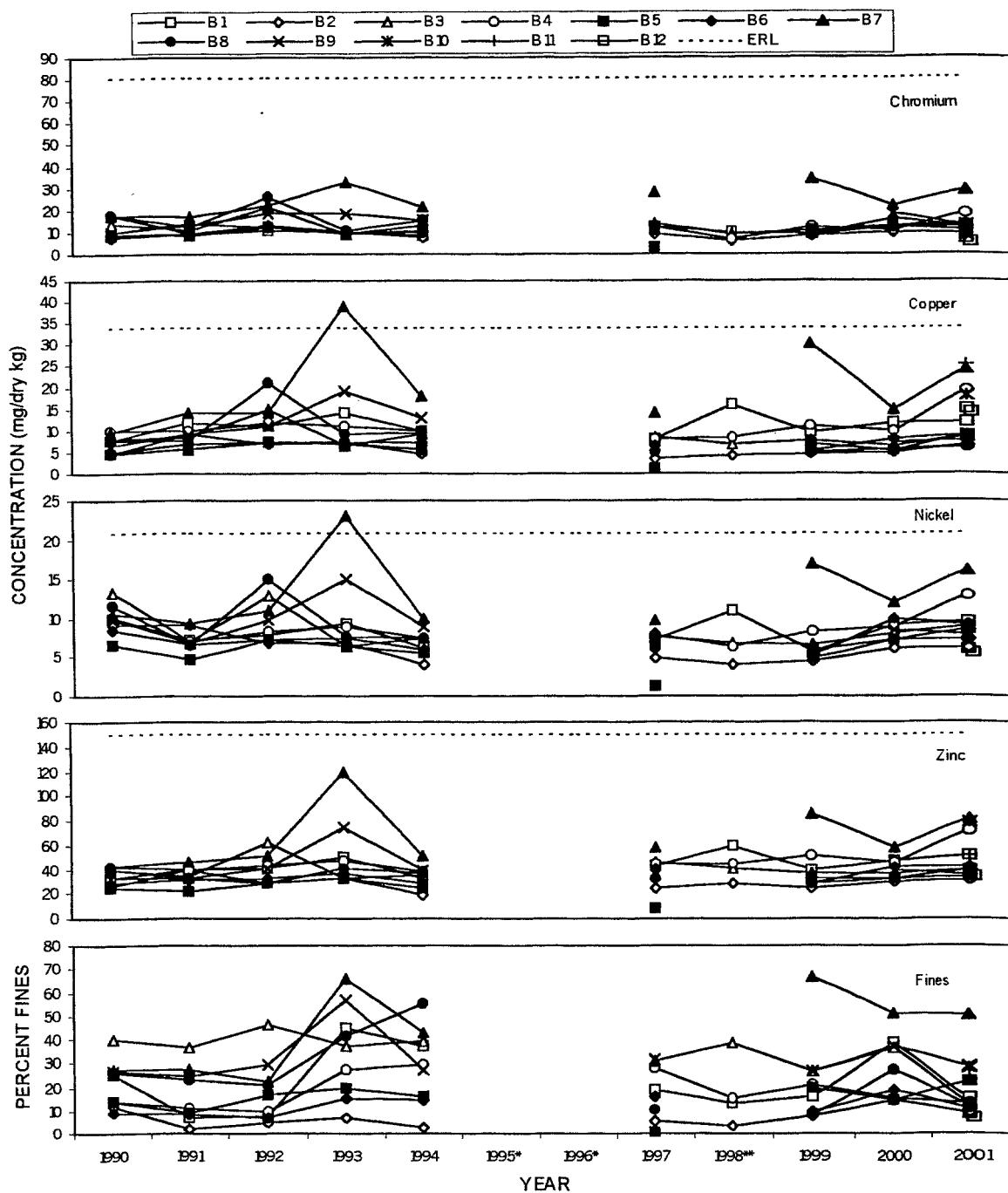
Sediment Chemistry

Highest metal concentrations in 2001 generally occurred offshore and upcoast of the mouth of the San Gabriel River at Station B7 (Figure 18). The lowest values for all metals in 2001 generally were found at Station B2, downcoast on the 12-ft isobath. Concentrations at the river stations were generally intermediate in value, although copper concentrations were highest at Station B11, while chromium and nickel were lowest at Station B12.

Differences in metal concentrations among sites are often directly related to the coarseness of the sediment. Fine-grained sediments may contain higher amounts of metals due to the greater surface area available (Ackermann 1980, de Groot et al. 1982). The distribution of metal levels is generally consistent with the relative amounts of fine and coarse sediments. Sediments in the study area are primarily sand, with varying amounts of finer sediments. In 2001, highest metal concentrations at Station B7 corresponded with finest sediments (50% silt and clay) at that station, while lower levels at Station B2 corresponded with the low level of finer sediments (9% silt and clay). The Long Beach Breakwater affords some protection from swells at Stations B3 and B7, resulting in finer sediments. Lowest concentrations in the river for chromium and nickel at Station B12 correspond to low levels of silt and clay (8.5%) at that station.

Elevated sediment metal levels may be toxic to some organisms. Ranges of toxicity have been developed by the National Oceanic and Atmospheric Administration (NOAA 1991) and later updated (Long et al. 1995) using data from spiked sediment bioassays, sediment-water equilibrium partitioning, and the co-occurrence of adversely affected fauna and contaminant levels in the field. Chemical concentrations, believed to be associated with adverse biological effects from the various independent studies, were compared for each parameter and the lower 10 percentile was designated as the "Effects Range-Low" (ERL). The median of concentration levels was designated

the "Effects Range-Median" (ERM). All metal concentrations in 2001 were less than the determined concentration for low effects; the ERLs are 81 mg/kg for chromium, 34 mg/kg for copper, 20.9 mg/kg for nickel, and 150 mg/kg for zinc. In 2001, mean metal levels (with the exception of copper) were generally two to five times lower than the respective ERL concentrations suggesting that the observed levels were not detrimental to the biological community offshore of the Haynes and AES Alamitos L.L.C. generating stations.



Note: * No data collected; ** Only four stations sampled

Figure 18. Comparison of sediment metal concentrations and percent fines by station, 1990 - 2001. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Pollutants come from a variety of sources of both industrial and domestic origin. Oil and gasoline combustion releases many substances, including cadmium, copper, chromium, lead, mercury, and zinc. These and other metals are used in paints, pigments, batteries, manufacturing, and protective coatings. Aerial fallout is a diffuse and potentially large source of contaminants derived from other sources and may include metals, chlorinated hydrocarbons, and PAHs (SCCWRP 1973, 1986). As these contaminants accumulate on the ground, they are washed into rivers by rainfall and are eventually deposited in the ocean.

Sediment metal levels in the study area have remained fairly constant since 1990 (Figure 18). In most cases, including this year, highest metal concentrations have corresponded with finest sediments, as evidenced by the trend observed at Station B7 since 1990. There is no indication that operation of the generating stations has had an appreciable effect on sediment metal levels.

MUSSEL BIOACCUMULATION

In 2001, bay mussels were collected from the study area for analysis of tissue metal concentrations. Bay mussel tissue collected from the San Gabriel River downstream of the discharge structures in 2001 had detectable levels of copper and zinc. Chromium and nickel concentrations were below detection limits.

In 1988, California State Mussel Watch (CSMW) found levels of copper between 16 and 23 mg/dry kg in resident California mussels (*Mytilus californianus*) collected in Santa Monica Bay (SWRCB 1990). The same study also found levels of copper between 3 and 29 mg/wet kg in transplanted California mussels collected in nearby Marina Del Rey. Mussel tissue analyzed from a reference site six km offshore of Newport Beach in 2001 had a mean copper concentration of 11 mg/dry kg (Table 7). Another reference site at the west end of Catalina Island had copper concentrations in whole bay mussels of 13 to 16 mg/dry kg. A study of copper concentrations conducted by CSMW and NOAA in the Southern California Bight from 1980 to 1986 found copper tissue levels ranging from 4.0 to 120 mg/dry kg (NOAA 1991). One conclusion was that copper appeared to be a contaminant in mussels principally near major recreational and industrial harbors, and secondarily near smaller harbors.

In the same CSMW and NOAA studies, zinc concentrations ranged from 80 to 560 mg/dry kg. In 2001, mean replicate zinc concentration in the study area was 170 mg/dry kg (ranging from 110 to 210 mg/dry kg). The concentration of zinc offshore of Newport Beach at one reference site was 150 mg/dry kg, while the Catalina reference site had concentrations of zinc ranging from 170 to 270 with a mean of 230 mg/dry kg.

Mussel tissue metal levels within ranges of those found in other studies indicate that there is no major source of metals in the study area.

BIOLOGICAL MONITORING

Benthic Infauna

The infaunal communities in the vicinity of the San Gabriel River mouth were dominated by small annelid worms and arthropod crustaceans typical of protected nearshore habitats in the Southern California Bight (EQA/MBC 1978, Soule and Oguri 1974). The offshore area was dominated by annelids and the river by arthropods. At offshore stations, species richness and diversity increased with depth, while abundance was highest at the center of the station array, and in the nearshore area. The high abundance and low species diversity at Station B1 near the river mouth were due primarily to the overwhelming numerical dominance of the infaunal communities by the polychaete *Mediomastus*. Abundances of other species in the community at this station were similar to those throughout the study area. The community at Station B2 also had low diversity but

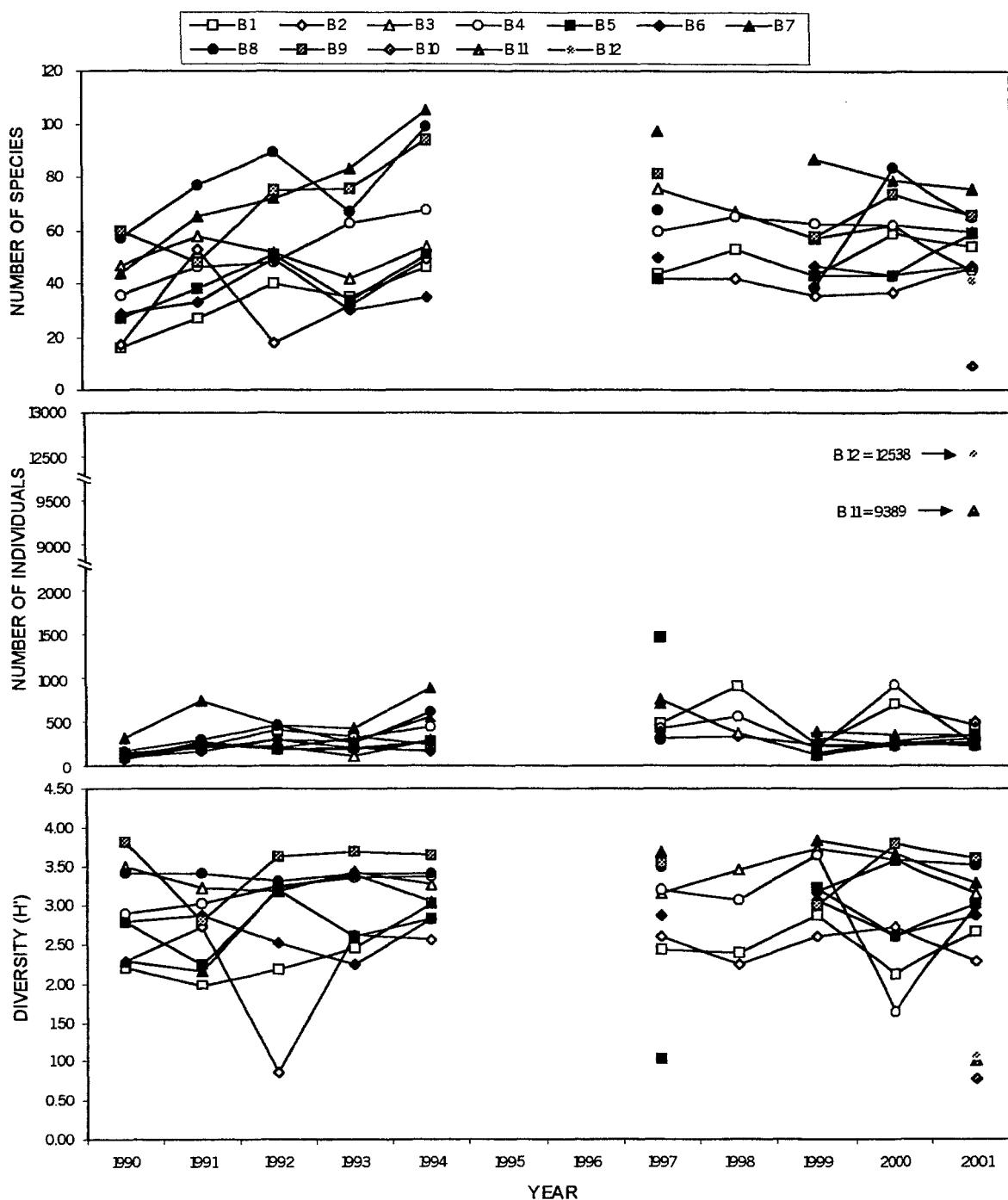
that was due to the overwhelming presence of the annelid polychaete *Owenia collaris*. The community at Station B7 was most distinct, having a somewhat different species composition, including the absence of the species dominant elsewhere and high abundance of species which are typical of calm environments, such as Los Angeles and Long Beach harbors. This is consistent with the station's somewhat protected location just inside the east end of the Long Beach Harbor breakwater. At river stations, species richness, diversity, and abundance all decreased upriver with the lowest of these parameters occurring at the control station (B10) above the generating station. Several of the species in abundance such as the arthropods *Erithonius*, *Grandidierella*, and probably *Monocorophium*, and the annelid *Streblospio* are common in estuarine and disturbed habitats. The three arthropods are mucus tube builders and *Grandidierella* is a relatively recent introduction, while *Monocorophium* was undoubtedly introduced far in the past. With the exception of the annelid *Streblospio*, which was abundant both in a mostly freshwater and a mostly saline environment, they appear to favor those areas of the river where freshwater influence is least. *Streblospio* is believed to have been introduced from the Atlantic coast and is known to undergo huge population fluctuations (Light 1978). This species is tolerant of estuarine conditions and is abundant in the river because of its opportunistic ability to rapidly respond to favorable conditions.

Sediment characteristics are known to affect and even control the distribution, abundance, and composition of benthic communities (Gray 1974, Dexter 1978). In particular, sediment grain size is especially important, as it influences properties such as ease of burrowing, availability of suitable particles for constructing burrows and tubes, and the amount of organic food material. Higher species richness with increased amounts of fines (silt and clay) have been reported for shallow subtidal, soft sediment locations (Knox 1977). Typically, sediments are coarser nearshore and become finer with distance from shore (and increasing depth). In general, sand faunas tend to be impoverished when compared to siltier offshore sands (Barnard 1963). Poorly sorted sediments (those with a larger assortment of particle sizes) tend to support more species than well sorted sediments, because they provide a variety of substrates for habitation and foraging.

Sediments in the study area in 2001 were generally finer upcoast and offshore, in deeper water and where the Long Beach Breakwater and Alamitos Bay jetties provide protection from disturbance of the substrate. Species richness and diversity were higher at these locations. Sediments were finest and most poorly sorted at Station B7, which was reflected in the infaunal community composition, as well as the high species richness and diversity. However, coarser-than-average sediments occurred at the mid-depth and deep stations directly off the river mouth. At Station B8, the deep station, species richness and species diversity was very high despite the coarser sediments, probably because those sediments were poorly sorted. At Station B2, the downcoast shallow station, however, the high percentage of sand in the sediments was reflected in a low species diversity, a result of high abundance and overwhelming dominance of the community by one species (62% of the individuals were *Owenia collaris*). Despite the strong correlation of community composition with sediment characteristics, distribution of some species appeared to be related to water depth, not with sediment type. The top species, *Owenia*, and two arthropod species, the cumacean *Diastylopsis tenuis*, and the amphipod *Rhepoxynius menziesi*, occurred almost exclusively at all of the shallow and mid-depth stations. None of the abundant species appeared to be restricted to the deeper water environment.

Infaunal communities in the offshore study area in 2001 were similar to those in previous surveys (MBC 1986, 1988, 1990-1994, 1997-2000a). As in the past, species richness and diversity were greater offshore than nearshore, while abundance was generally higher nearshore (Figure 19). The lower species richness and diversity nearshore is typical of habitats disturbed by wave action. In 2001, the low species diversity at Station B2 was due to the unusually high abundance of *Owenia*. Low diversities occurred at Station B5 in 1997, due to a high number of nematodes, and at Station B2 in 1992, due to an abundance of the polychaete *Apopriionospio pygmaea* (MBC 1992, 1997).

Owenia collaris was tied for the most abundant species in 2001, although it was not abundant at all stations. This species has been known to undergo very successful recruitment



Note: * No data collected; ** Only four stations sampled

Figure 19. Comparison of infaunal community parameters, 1990 - 2001. Haynes and AES Alamitos L.L.C. Generating Stations NPDES, 2001.

episodes, followed by crashes in the populations. It has been among the dominant species since 1991, but has not previously exceeded 10% of the fauna (MBC 1991-1994, 1997-2000a). The small annelid worm *Mediomastus acutus*, is typically the species next most abundant, but in 2001 it was tied for the top position. The small annelids *Apoprionospio pygmaea* and *Mediomastus* spp. and the cumacean *Diastylopsis tenuis*, have dominated the communities in the study area and they

continued to be abundant in the study area in 2001. Of the species occurring in surveys of the study area since 1988, 18 species have each comprised 1% or more of the long-term abundance, all but one occurred in 2001. That taxa was nematoda which had an unusual occurrence in 1997 not seen before or since (Appendix G-5). This core group of species includes 11 species of annelid worms (in addition to the four mentioned previously, *Goniada littorea* and *Cossura* sp. A were also very abundant), two species of ostracods (*Euphilomedes longiseta* and *E. carcharodonta*), and two species of amphipods (*Amphideutopus oculatus* and *Rhepoxyrius menziesi*). These species are all typical of the sandy, shallow subtidal of the nearshore shelf of southern California (Barnard 1963). Relative abundances of these species have varied from year to year (*Owenia* comprised just over 2% of the fauna in 1999 and did not occur in 1986 and 1988), but the basic composition of the communities has experienced no apparent change.

Table 21. The 10 most abundant fish species taken by otter trawl, 1972-2001. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

common name	Year														Total	F.O.
	1972	1978	1980	1986	1988	1990	1991	1992	1993	1994	1997	1999	2000	2001		
northern anchovy	1659	166	2486	52	135	2951	34952	405	3453	14658	3108	1006	4001	23	69055	14
white croaker	1297	9296	3731	3319	1844	669	980	1775	2335	2635	409	1625	689	399	31003	14
queenfish	2081	599	1615	1761	276	2891	213	962	1439	6097	14	426	68	103	18545	14
California tonguefish	222	822	21	266	259	33	76	105	297	100	14	54	10	38	2317	14
white seaperch	1536	225	256	5	9	3	8	9	16	32	55	13	14	15	2196	14
speckled sanddab	254	38	17	38	369	192	154	98	114	58	15	108	72	114	1641	14
shiner perch	1173	37	21	1	4	1	-	2	1	19	14	22	1	10	1306	13
California halibut	110	31	39	76	101	90	92	64	62	47	92	92	97	38	1031	14
spotted turbot	-	1	4	62	95	73	83	68	63	46	26	48	24	27	620	13
walleye surferch	446	8	36	-	-	5	1	2	9	13	1	-	-	1	522	10
Survey totals																
Number of individuals	9618	11547	8562	6070	3386	7108	36765	3693	8065	23889	3856	3719	5092	865		
Number of species	36	34	29	34	31	30	28	33	34	38	24	34	23	27		
Stations/Replicates	7/1	8/1	6/1	7/1	7/2	6/2	6/2	6/2	6/2	6/2	6/2	6/2	6/2	6/2		
Seasons sampled	3	2	2	2	2	2	2	2	2	2	1	2	2	2		

F.O. = Frequency of occurrence

No effects of the generating stations' discharges on the benthic infaunal community in the river or offshore study area were apparent. The communities were typical of those in similar habitats, and differences among stations were due to sediment characteristics as influenced by depth and protection from wave action.

Fish and Macroinvertebrates

Trawls

White croaker dominated the fish abundance in 2001, and has been the second overall most dominant species in previous otter trawl surveys (Table 21, EQA/MBC 1973, MBC 1979, 1981, 1986, 1988, 1990-1994, 1997, 1999, 2000a). This is a schooling species that meanders throughout the study area, therefore, its presence can be overwhelming or completely absent at any location, depending on chance.

White croaker was taken in greater abundance in the winter than the summer. In general, biomass and abundance was greatest or least, dependent upon the location of white croaker schools. The white croaker population in winter was characterized by a mode at 40 mm SL (Figure 12). White croaker mature at approximately one year at a length of 120 to 130 mm SL (Love et al. 1984). As such, the winter trawls yielded predominantly fish of less than one year in age. In contrast, the summer survey length distribution had a primary mode above 180 mm SL. Therefore, the largest portion of the summer catch of white croaker would be considered to be Age-1 adults spawned the previous summer.

Speckled sanddab was the second most abundant fish collected overall in the 2001 survey. The winter catch was much more abundant than the summer and also had a slightly higher average length. It is sixth in the overall record of abundance since 1972 (Table 21). Speckled sanddab is a sandy-bottom dweller that is typically found in shallow-water from Prince William Sound, Alaska to southern Baja California.

California halibut had the most biomass and was fifth in abundance overall. It was more abundant in winter than in summer, and was relatively uniformly distributed throughout all the stations during both seasons. It ranks eighth in the overall record and has since been taken in every survey. It is a common inhabitant of the nearshore waters in the Southern California Bight. California halibut populations in winter had too few individuals to determine a meaningful age structure for the population; however, a few groupings of individuals (modes) were elicited from the data at 170 mm SL and 280 mm SL during the winter survey (Figure 13). Summer population data again had too few samples for definitive modes, but there was a grouping at 290 mm SL. California halibut attain a length of about 160 mm SL at one year of age (Love 1996). They are approximately four or five years old at a length of about 500 mm SL. Most of the fish taken in summer and winter were age one to three years, although there were a few fish up to five years of age (Love and Brooks 1990).

Northern anchovy is collectively the most abundant species when including previous surveys, but was found in much lower abundance in this survey (Table 21). Due to the schooling nature of northern anchovy and depending on chance, they can be very abundant in the catch or completely absent. All of the northern anchovy captured in the 2001 trawl surveys were less than 64 mm SL which correlates to larvae or juveniles and were most likely less than six months in age (Table 13).

In the otter trawl winter station dendrogram (Figure 14), a grouping of Stations T2, T3, and T6 appeared to be based upon the greater abundance of queenfish and white croaker; the other group (comprising the two offshore stations, Stations T4 and T5, and the inshore upcoast station, T1) appeared to be based upon the higher abundance of speckled sanddab, California halibut, and spotted turbot as well as a more uniform distribution of abundance among the other species. In the summer species dendrogram Station T4 is separated from the others because it had the highest abundance, species richness, and the highest diversity value (H'). The next grouping consists of T1, T2, and T5 which had the lowest abundance and species richness. The two stations (Stations T3 and T6) that comprise the third group are downcoast and are intermediate in abundance, species richness, and diversity.

All 27 of the species taken in 2001 have been taken in prior surveys, although this is the least abundance (865 individuals) taken since sampling started in 1972. Species richness has previously ranged from 23 species in 2000 to 38 species in 1994, and abundance has ranged from 3,386 individuals in 1988 to 36,765 individuals in 1991. Combining both seasons of 2001, white croaker and California halibut occurred at all six stations. Speckled sanddab also occurred at six stations and spotted turbot at five stations, both in winter. These have been important species in past surveys with average ranks that place them as a member of the important recurring group that characterizes the coastal area (Appendix H-13).

The species composition of the fish taken in the 2001 trawl surveys was quite typical for the Southern California Bight (Love et al. 1986). A recurring group of fish was again common to the study area in both winter and summer. The most abundant 10 species overall were present in 2001 and eight of these were among the 10 most abundant in 2001. These are species that are common inhabitants of the inshore areas of the Southern California Bight and are expected to be found during trawls in similar areas. Schooling species generally have patchy distributions, with large concentrations in some areas and virtually absent in others, while those species that prefer the benthic habitat such as California halibut, California tonguefish, hornyhead turbot, speckled sanddab, California lizardfish, etc. are found more uniformly distributed throughout the study area. The distribution data seen during the 2001 surveys is typical of these species (Table 11).

Invertebrate abundance in 2001 (1,349 individuals) was the highest among all the previous years sampled. Yearly values for invertebrate abundance have ranged from a low of 61 individuals in 1980 to a high of 982 in 1993 (MBC 1979, 1981, 1986, 1988, 1990-1994, 1997, 1999, 2000a). The total biomass in 2001 (7.10 kg) was the fourth highest of any of the years when biomass was reported, which had an average of 5.84 kg per year (MBC 1988, 1990-1994, 1997, 1999, 2000a). Invertebrate abundance and biomass were considerably higher in winter than in summer. For the year, blackspotted bay shrimp comprised 52% of the total abundance and 10% of the total biomass. Tuberculate pear crab, spiny sand star, and tortellini snail were other dominants in abundance, and short-spined seastar and spiny sand star were the other dominants in the biomass.

Spiny sand star and blackspotted bay shrimp were taken at five or more of the stations during both seasons. Tuberculate pear crab had the second highest total abundance and was collected mainly at the nearshore stations in both winter and summer. There were no other apparent trends of invertebrate abundance or biomass along the coast during either survey.

Blackspotted bay shrimp was taken at every station and was by far the most abundant species. It is a common species found from the Gulf of Farallons to Baja California in depths from 10 to 100 ft (Reilly 1992), preferring mud and sand bottoms. Annual abundance off California varies widely, sometimes by more than tenfold (Siegfried 1989). Blackspotted bay shrimp is an important food source for the principal sport and commercial fishes of the Pacific coast. As adults the dominant fish species in the 2001 survey, white croaker, feed on small animals which could include blackspotted bay shrimp (Wild 1992).

Impingement

Haynes. Impingement surveys to evaluate fish and macroinvertebrate losses were conducted at Haynes Generating Station during 16 heat treatment operations. In these surveys, 11 species of fish and 242 individuals weighing 2.705 kg were taken. The high number of juvenile queenfish impinged at Unit 6 on 11 July 2001 greatly influenced the catch average per heat treatment (15.1 individuals). Eliminating this survey, the catch average is less than three fish per heat treatment. Fifteen species of macroinvertebrates were also taken. They represented 74 individuals amassing a weight of 1.030 kg.

Alamitos. Impingement surveys to evaluate fish and macroinvertebrate losses were conducted at AES Alamitos L.L.C. generating station during four heat treatment operations. In these surveys, 15 species of fish and 134 individuals weighing 3.542 kg were taken. The catch average per heat treatment was 33.5 individuals. Nine species of macroinvertebrates, representing 244 individuals amassing a weight of 1.811 kg also were taken.

Fish and macroinvertebrates impinged at the two generating stations are typical inhabitants of the bay environment. Most fish species taken were small individuals, indicating the bay area constitutes a nursery area for many of these species, similar to what is seen in Los Angeles and Long Beach Harbors (MBC 2000b, 2000c). Fish impinged during heat treatment surveys are removed from the two separate intake canals that supply water to the generating stations. Water flow into the pumps is not constrained by a concrete enclosure, but is open to the main body of the canal. The procedure by which heated water is recirculated during the fouling control procedure (heat treatment) allows the fish present in either canal to swim away from the warmer water which minimizes the number of individuals impinged on the screening system. Because fish have an opportunity to leave the vicinity of the warmer water, fish loss during heat treatments at both Haynes and AES Alamitos L.L.C. generating stations is negligible.

The generating stations, therefore, are not having an unduly adverse effect on the nekton population of Alamitos Bay.

CONCLUSIONS

Results of the 2001 NPDES water quality surveys indicated only localized effects of the cooling water discharge on the receiving waters in the San Gabriel River and at offshore stations. During winter, warmer surface waters were limited to the San Gabriel River and nearshore Stations RW1 through RW5. During winter a plankton bloom was present in the study area, resulting in higher DO concentrations and pH values at several stations in San Pedro Bay. In summer, temperature elevations were limited to the river and the mouth of the river (Station RW1). Lower pH values and low bottom DO values at Station RW10, upstream of the generating stations, are the result of freshwater influence at that station. High surface DO values at Station RW10 are the result of a plankton bloom. All values recorded in 2001 were well within the range of values recorded in the study area in previous surveys.

Sediments in the 2001 offshore study area consisted primarily of sand, with an average grain size in the very fine sand category. Sediments at Stations B1, B2, B3, and B4 were fairly similar, while those at Station B6 were coarser and at Stations B5 and B9 were finer. Sediments at Station B7, at a depth of 40 ft and upcoast of the river, were finer than elsewhere, probably due to protection from swells by the Long Beach Breakwater. Those at Station B8, were coarser probably because of a lack of protection from swells.

Samples taken at three stations in the San Gabriel River were variable but composed mostly of sand, with an average mean grain size in the medium sand category. Sediments graded from coarser to finer upriver indicating the river is the source of the fines offshore. Results indicated that there were no effects from the generating stations on the sediments offshore or in the San Gabriel River.

Sediment metal levels throughout the survey area in 2001 were similar to those found in surveys since 1990. Generally highest metal levels were found offshore and upcoast of the mouth of the San Gabriel River, at Station B7, where finest sediments occurred. River stations were generally intermediate in value in comparison to the offshore stations. All metal concentrations in 2001 were within ranges seen in past surveys and are unlikely to adversely affect the local biota. It does not appear that the operation of the Haynes and AES Alamitos L.L.C. generating stations has had an adverse effect on the metal levels in the area.

In 2001, mean copper and zinc concentrations from mussel tissue collected from the San Gabriel River downstream of the Haynes and AES Alamitos L.L.C. generating stations were at or below levels noted in both the state mussel watch program and at two reference stations. All metal concentrations were within ranges found in other surveys in the Southern California Bight. Neither chromium nor nickel was detected in mussel tissue from either the San Gabriel River or the reference stations. These results indicate that the operation of the two generating stations are not having an appreciable effect on the bioaccumulation of these metals.

The infaunal communities in the San Gabriel River and offshore of the river mouth in 2001 were dominated by small annelid worms and arthropod crustaceans typical of protected nearshore habitats in the Southern California Bight, and were similar to those previously seen in the study area. Community parameters were similar among stations, although abundance was greater at the nearshore stations off the river mouth, and species richness and diversity generally increased with depth. Infaunal community differences among stations appeared to be related to sediment characteristics as influenced by depth and protection from wave action. No effects of the generating stations' discharges on the benthic infaunal community in the river or the offshore study area were apparent.

The 2001 fish assemblage was dominated by white croaker, speckled sanddab, and queenfish. These three species have been among the six most abundant species in all surveys conducted in the area since 1972. Blackspotted bay shrimp was the most abundant invertebrate

collected in the trawl survey. The consistency of the fish and invertebrate assemblages through time indicate that the Haynes and AES Alamitos L.L.C. discharges are not affecting either the abundance or distribution of these assemblages.

Entrainment rates during heat treatment fish surveys at both the Haynes Generating Station and AES Alamitos L.L.C. generating station were low, indicating that the two generating stations have a negligible effect on the nekton populations of Alamitos Bay.

The overall results of the 2001 NPDES monitoring program indicated that operation of the Haynes and AES Alamitos L.L.C. generating stations had no detectable effects on the beneficial uses of the receiving waters.

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PERSONAL COMMUNICATIONS

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APPENDIX A

Receiving water monitoring specifications

Monitoring and Reporting Program No. CI-2769
City of Los Angeles, Department of Water and Power
Haynes Generating Station

CA0000353

B. Receiving Water Monitoring

The receiving water monitoring program shall consist of periodic biological surveys of the area surrounding the discharge, and shall include studies of those physico-chemical characteristics of the receiving waters which may be impacted by the discharge.

This program may be performed as a joint effort with AES Alamitos, L.L.C., in connection with the Receiving Water Monitoring Program for the Alamitos Generating Station.

Location of Sampling Stations (see attached figure 3) :

- 1. Receiving water stations offshore of the San Gabriel River shall be located as follows :**

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- a. Station RW1 – Seaward of the southeast San Gabriel River Jetty, at a depth of 12 feet.
 - b. Station RW2 - 500 feet down-coast of the Seal Beach Pier, at a depth of 12 feet
 - c. Station RW3 - directly offshore of station RW6, at a depth of 20 feet.
 - d. Station RW4 - directly offshore of station RW1, at a depth of 20 feet.
 - e. Station RW5 - directly offshore of Station RW2, at a depth of 20 feet.
 - f. Station RW6 - 2,600 feet up-coast of the northwest Alamitos Bay Jetty at a depth of 12 feet.
 - g. Station RW7 - directly offshore of station RW3, at a depth of 40 feet.
 - h. Station RW8 - directly offshore of station RW4, at a depth of 40 feet.
 - i. Station RW9 - directly offshore of station RW5, at a depth of 40 feet.
2. Receiving water stations in the San Gabriel River shall be located as follows :
- a. Station RW10 - at the 7th Street Bridge, at a point midway between the banks of the river.
 - b. Station RW11 - at the Westminster Avenue Bridge, at a point midway between the banks of the river.
 - c. Station RW12 - at the Pacific Coast Highway Bridge, at a point midway between the banks of the river.

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3. Benthic stations shall be located as follows:

- a. Station B1 through B12 shall be located directly beneath Stations RW1 through RW12, respectively.

4. Trawling stations shall be located as follows :

- a. Station T1 shall be located directly beneath station RW3.
- b. Station T2 shall be located directly beneath station RW4.
- c. Station T3 shall be located directly beneath station RW5.
- d. Station T4 shall be located directly beneath station RW7.
- e. Station T5 shall be located directly beneath station RW8.
- f. Station T6 shall be located directly beneath station RW9.

C. Type and Frequency of Sampling:

1. Temperature profiles shall be measured semi-annually (summer and winter) each year at Stations RW1 through RW12 from surface to bottom at a minimum of one-meter intervals. Dissolved oxygen levels and pH shall be measured semi-annually at the surface, mid-depth and bottom at each station, at a minimum. All stations shall be sampled on both a flooding tide and an ebbing tide during each semi-annual survey.
2. Sampling by otter trawl shall be conducted semi-annually (summer and winter) each year along transects at Stations T1 through T6.
 - a. Trawl net dimensions shall be as follows:
 1. At least a 25 foot throat width.
 2. 1.5 in mesh-size (body).
 3. 0.5 in mesh-size (liner in the cod end)
 - b. Two replicate trawls shall be conducted at each at each station for a duration of 10 minutes each at a uniform speed between 2.0 and 2.5 knots.
 - c. The identity, size (standard length), wet weight, and number of

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fish in each trawl shall be reported. The number of fish affected by abnormal growth or disease, such as fin erosion, lesions, and papillomas, shall be reported. Fish species shall be reported in rank order of abundance and frequency of occurrence for each trawl. The Shannon-Wiener diversity index shall also be computed for each trawl.

- d. All commercially important macroinvertebrates shall be identified, enumerated, and reported in the same manner as fish species.

3. Benthic sampling shall be conducted annually during the summer at Stations B1 through B12.

- a. One liter sediment core samples shall be collected by divers at each of the benthic stations for biological examination and determination of biomass and diversity, and for sediment analyses. Four replicates shall be obtained at each station for benthic analyses, and each shall be analyzed separately. A fifth sample shall be taken at each station for sediment analyses and general description.

- b. Each benthic replicate sample shall be sieved through a 0.5 mm standard mesh screen. All organisms recovered shall be enumerated and identified to the lowest taxon possible. Infaunal organisms shall be reported as concentrations per liter for each replicate and each station. Total abundance, number of species and Shannon-Weiner diversity indices shall be calculated (using natural logs) for each replicate and each station.

Biomass shall be determined as the wet weight in grams or milligrams retained on a 0.5 millimeter screen per unit volume (e.g., 1 liter) of sediment. Biomass shall be reported for each major taxonomic group (e.g., polychaetes, crustaceans, mollusks) for each replicate and each station.

- c. Sediment grain size analyses shall be performed on each sediment sample (sufficiently detailed to calculate percent weight in relation to phi size). During the first year of the permit, sub-samples (upper two centimeters) shall be taken from each sediment sample and analyzed for copper, chromium, nickel and zinc.

The first year's data will be carefully evaluated and the Executive Officer shall decide whether to continue, modify or eliminate the sediment sampling component of the monitoring program.

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4. The following general observations or measurements at receiving water and benthic stations shall be reported.
 - a. Tidal stage and time of monitoring.
 - b. General water conditions.
 - c. Extent of visible turbidity or color patches.
 - d. Appearance of oil films or grease, or floatable material.
 - e. Depth at each station for each sampling period.
 - f. Presence or absence of red tide.
 - g. Presence of marine life.
 - h. Presence and activity of the California least tern and the California brown pelican.
5. Native California mussels (*Mytilus californianus*) shall be collected during the summer from the discharge conduit, at Stations RW10 and RW12, for bioaccumulation monitoring. The mussels shall be collected and analyzed as described in Appendix A of the "California State Mussel Watch Marine Water Quality Monitoring Program 1985-86" (Water Quality Monitoring Report No. 87-2WQ). Mussel tissue shall be analyzed for copper, chromium, nickel, and zinc at a minimum. Should native mussels not be available to collect, an alternative proposal to evaluate bioaccumulation effects from the discharge shall be proposed by the Discharger. Approval for this substitution and the work plan shall be made by the Executive Officer.

SUMMARY OF RECEIVING WATER MONITORING

<u>Parameter</u>	<u>Units</u>	<u>Stations</u>	<u>Type of Sample</u>	<u>Minimum Frequency</u>
Temperature	°C	RW1-RW12	vertical profile	semi-annually (flood, ebb)
Dissolved oxygen	mg/L	RW1-RW12	vertical profile	semi-annually (flood, ebb)

Appendix A-1. (Cont.).

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<u>Parameter</u>	<u>Units</u>	<u>Stations</u>	<u>Type of Sample</u>	<u>Minimum Frequency</u>
pH	pH units	RW1-RW12	vertical profile	semi-annually (flood, ebb)
Fish and macro invertebrates	—	T1 – T6	trawl	semi-annually
Benthic infauna	—	B1-B12	grab	annually
Sediments	—	B1-B12	grab	annually
Mussels	—	RW10 & RW12	grab	annually

V. STORM WATER POLLUTION PREVENTION PLAN (SWPPP) MONITORING AND REPORTING

The Discharger shall implement the attached Storm Water Monitoring and Reporting Program (Section A of Attachment A) which shall be coordinated with the Monitoring and Reporting Program.

Ordered by:

Dennis A. Dickerson
Executive Officer

Date: June 29, 2000

Appendix A-1. (Cont.).

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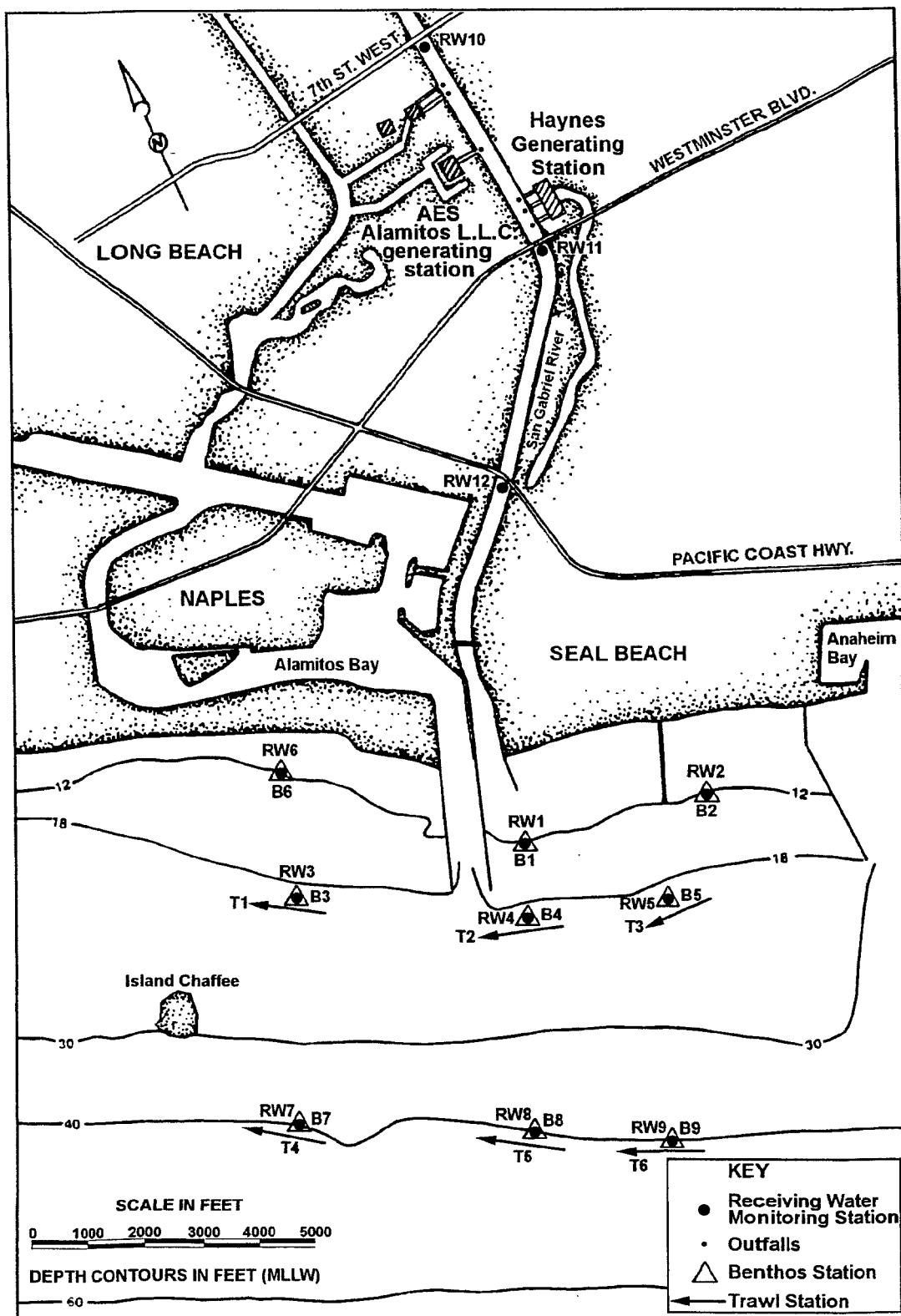


Figure 3. Locations of the sampling stations. Haynes Generating Station.

B. Receiving Water Monitoring

The receiving water monitoring program shall consist of periodic biological surveys of the area surrounding the discharge, and shall include studies of those physico-chemical characteristics of the receiving waters which may be impacted by the discharge.

This program may be performed as a joint effort with the City of Los Angeles, in connection with the Receiving Water Monitoring Program for the Haynes Generating Station.

Location of Sampling Stations (see attached figure):

1. Receiving water stations offshore of the San Gabriel River shall be located as follows:
 - a. Station RW1 - seaward of the southeast San Gabriel River Jetty, at a depth of 12 feet.
 - b. Station RW2 - 500 feet downcoast of the Seal Beach Pier, at a depth of 12 feet.
 - c. Station RW3 - directly offshore of Station RW6, at a depth of 20 feet.
 - d. Station RW4 - directly offshore of Station RW1, at a depth of 20 feet.
 - e. Station RW5 - directly offshore of Station RW2, at a depth of 20 feet.
 - f. Station RW6 - 2,600 feet upcoast of the northwest Alamitos Bay Jetty at a depth of 12 feet.
 - g. Station RW7 - directly offshore of Station RW3, at a depth of 40 feet.

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AES Alamitos, L.L.C. (Alamitos Generating Station)

CA0001139

- h. Station RW8 - directly offshore of Station RW4, at a depth of 40 feet.
 - i. Station RW9 - directly offshore of Station RW5, at a depth of 40 feet.
 2. Receiving water stations in the San Gabriel River shall be located as follows:
 - a. Station RW10 - at the 7th Street Bridge, at a point midway between the banks of the river.
 - b. Station RW11 - at the Westminster Avenue Bridge, at a point midway between the banks of the river.
 - c. Station RW12 - at the Pacific Coast Highway Bridge, at a point midway between the banks of the river.
 3. Benthic stations shall be located as follows:
 - a. Stations B1 through B12 -directly beneath Stations RW1 through RW12, respectively.
 4. Trawling stations shall be located as follows:
 - a. Station T1- directly beneath Station RW3.
 - b. Station T2 - directly beneath Station RW4.
 - c. Station T3 - directly beneath Station RW5.
 - d. Station T4 - directly beneath Station RW7.
 - e. Station T5 - directly beneath Station RW8.
 - f. Station T6 - directly beneath Station RW9.
- C. Type and Frequency of Sampling:
1. Temperature profiles shall be measured semi-annually (summer and winter) each year at Stations RW1 through RW12 from surface to bottom at a minimum of one-meter intervals. Dissolved oxygen levels and pH shall be measured semi-annually at the surface, mid-depth, and bottom at each station, at a minimum. All stations shall be sampled on both a flooding tide and an ebbing tide during each semi-annual survey.
 2. Sampling by otter trawl shall be conducted semi-annually (summer and winter) each year along transects at Stations T1 through T6.

Appendix A-2. (Cont.).

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AES Alamitos, L.L.C. (Alamitos Generating Station)

CA0001139

- a. Trawl net dimensions shall be as follows:
 - (1) At least a 25 foot throat width.
 - (2) 1.5" mesh size (body)
 - (3) 0.5" mesh size (liner in the cod end)
 - b. Two replicate trawls shall be conducted at each station for a duration of 10 minutes each at a uniform speed between 2.0 and 2.5 knots.
 - c. The identity, size (standard length), wet weight, and number of fish in each trawl shall be reported. The number of fish affected by abnormal growth or disease, such as fin erosion, lesions, and papillomas, shall be reported. Fish species shall be reported in rank order of abundance and frequency of occurrence for each trawl. The Shannon-Wiener diversity index shall also be computed for each trawl.
 - d. All commercially important macroinvertebrates shall be identified, enumerated, and reported in the same manner as fish species.
3. Benthic sampling shall be conducted annually during the summer at Stations B1 through B12.
- a. One liter sediment core samples shall be collected by divers at each of the benthic stations for biological examination and determination of biomass and diversity, and for sediment analyses. Four replicates shall be obtained at each station for benthic analyses, and each shall be analyzed separately. A fifth sample shall be taken at each station for sediment analyses and general description.
 - b. Each benthic replicate sample shall be sieved with a 0.5 mm standard mesh screen. All organisms recovered shall be enumerated and identified to the lowest taxon possible. Infaunal organisms shall be reported as concentrations per liter for each replicate and each station. Total abundance, number of species and Shannon-Weiner diversity indices shall be calculated (using natural logs) for each replicate and each station.
- Biomass shall be determined as the wet weight in grams or milligrams retained on a 0.5 millimeter screen per unit volume (e.g., 1 liter) of sediment. Biomass shall be reported for each major taxonomic group (e.g., polychaetes, crustaceans, mollusks) for each replicate and each station.
- c. Sediment grain size analyses shall be performed on each sediment sample (sufficiently detailed to calculate percent weight in relation to phi size). During the first year of the permit, sub-samples (upper two centimeters) shall be taken from each sediment sample and analyzed for copper, chromium, nickel and zinc.
4. The following general observations or measurements at receiving water and

T11 76

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- benthic stations shall be reported.
- a. Tidal stage and time of monitoring.
 - b. General water conditions.
 - c. Extent of visible turbidity or color patches.
 - d. Appearance of oil films or grease, or floatable material.
 - e. Depth at each station for each sampling period.
 - f. Presence or absence of red tide.
 - g. Presence of marine life.
- h. Presence and activity of the California least tern and the California brown pelican.
5. During periodic maintenance of the intake structure and discharge of calcareous material to the receiving waters, the following observations or measurement shall be recorded and reported in the next monitoring report:
 - a. Date and times of discharge(s).
 - b. Estimate of volume and weight of discharge(s).
 - c. Composition of discharge(s).
 - d. General water conditions and weather condition.
 - e. Appearance and extent of visible turbidity or color patches.
 - f. Appearance and extent of any oil films or grease, floatable material or odors.
 - g. Presence of marine life.
 - h. Presence and activity of the California least tern and the California bown pelican.
 6. Native California mussels (Mytilus californianus) shall be collected during the summer from the discharge conduit, at Stations RW10 and RW12, for bioaccumulation monitoring. The mussels shall be collected and analyzed as described in Appendix A of the "California State Mussel Watch Marine Water Quality Monitoring Program 1985-86" (Water Quality Monitoring Report No. 87-2WQ). Mussel tissue shall be analyzed for copper, chromium, nickel, and zinc at a minimum.

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CA0001139

Should native mussels not be available to collect, an alternative proposal to evaluate bioaccumulation effects from the discharge shall be proposed by the Discharger. Approval for this substitution and the workplan shall be made by the Executive Officer.

7. Summary of Receiving Water Monitoring

<u>Parameter</u>	<u>Units</u>	<u>Stations</u>	<u>Type of Sample</u>	<u>Minimum Frequency</u>
Temperature	°C	RW1-RW12	vertical profile	semi-annually (flood, ebb)
Dissolved oxygen	mg/L	RW1-RW12	vertical profile	semi-annually (flood, ebb)
pH	pH units	RW1-RW16	vertical profile	semi-annually (flood, ebb)
Fish and macro invertebrates	—	T1- T6	trawl	semi-annually
Benthic infauna	—	B1-B12	grab	annually
Sediments	—	B1-B12	grab	annually
Mussels	—	RW10 & RW12	grab	annually

V. Notification

The Discharger shall notify the Executive Officer in writing prior to discharge of any chemical, which may be toxic to aquatic life. Such notification shall include:

1. Name and general composition of the chemical,
2. Frequency of use,
3. Quantities to be used,
4. Proposed discharge concentrations and,
5. EPA registration number, if applicable.

No discharge of such chemical shall be made prior to receiving the Executive Officer's approval.

VI. Storm Water Monitoring and Reporting

The Discharger shall implement the attached Storm Water Monitoring and Reporting Program (Section B of the Attachment A) which shall be coordinated with the Monitoring and Reporting Program.

Ordered by: Dennis A. Dickerson

Dennis A. Dickerson
Executive Officer

Date: June 29, 2000
/KL

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Appendix A-2. (Cont.).

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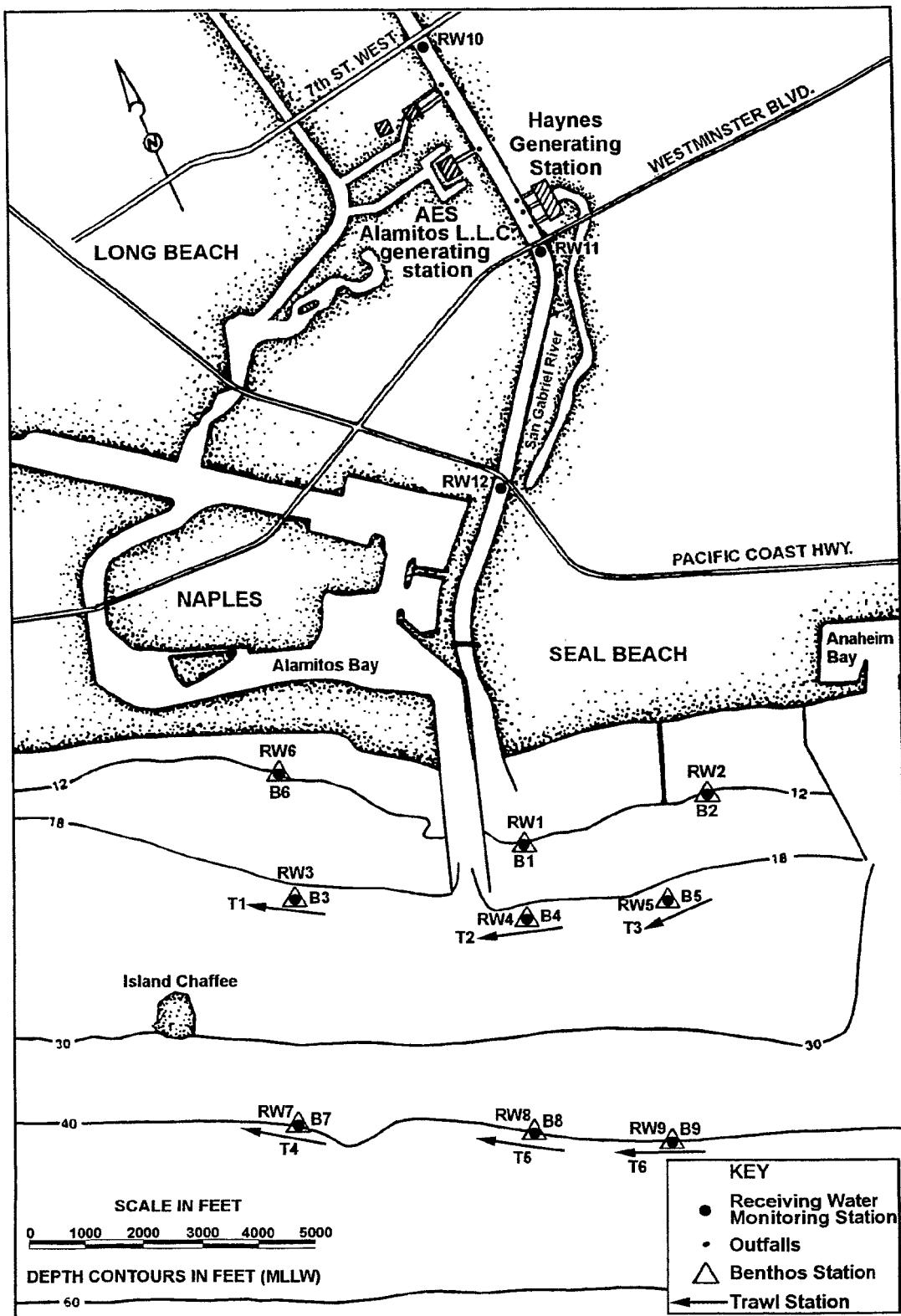


Figure 1. Locations of the sampling stations. AES Alamitos L.L.C. generating station.

APPENDIX B

Grain size techniques

Appendix B. Grain size techniques.

Sediment Grain Size Analysis

Analysis of sediment samples for size distribution characteristics are performed using two techniques. Sediments in the gravel size range (> 2.0 mm in diameter) are analyzed using a series of standard sieves having screen openings of 0.5 phi increments (diameter in phi units = -log₂ diameter in mm, or = -ln diameter in mm ÷ ln 2). The sand-silt-clay fraction of sediments [-1 phi through 4 phi (2.0 mm through 0.0625 mm) for sand], [4 phi through 8 phi (0.0625 mm through 0.004 mm) for silt, 8 phi and greater for clay (0.0039 mm and smaller)] is analyzed by laser light diffraction. The sample is suspended in a suspension column and continuously circulated through the laser beam. The laser beam passes through the sample where the suspended particles scatter incident light. Fourier optics collect diffracted light and focus it on to three sets of detectors. A composite, time-averaged diffraction pattern is measured by 126 detectors. Sizes are computed and summed into normal distribution classifications.

Laboratory data from the two methods are mathematically combined and entered into a computer program which calculates and prints size-distribution characteristics and plots both interval and cumulative frequency distribution curves.

Analysis of the plotted cumulative size frequency curves is performed as described by Inman (1952). The median, 5th, 16th, 84th, and 95th percentiles (converted to phi notation) of the sediment distribution curve is used to calculate mean grain size diameter, sorting coefficient, and measures of skewness and kurtosis. Where sediment distribution coincides with a normal distribution curve, the 16th and 84th percentiles represent diameters one standard deviation on either side of the mean. The following formulas are used in the calculations:

1. Mean Diameter (M_ϕ) is the average particle size in the central 68% of the distribution.

$$M_\phi = (\phi_{16} + \phi_{50} + \phi_{84}) / 3$$

2. Sorting (σ_ϕ) measures the uniformity (or non-uniformity) of particle quantities in each size category of the sediment distribution. A σ_ϕ value under 0.35 ϕ indicates that particles are very well sorted (i.e. sediments are primarily composed of a narrow range of size classes, or a single size class), while a value of over 4.0 ϕ indicates that the sediments are extremely poorly sorted, or evenly distributed among size classes.

$$\sigma_\phi = \frac{\phi_{84} - \phi_{16}}{4} + \frac{\phi_{95} - \phi_5}{6.6}$$

3. Skewness (α_ϕ) is a measure of the direction and extent of departure of the mean from the median (in a normal or symmetrical curve they coincide). In symmetrical curves, $\alpha_\phi=0.00$ with limits of -1.00 and +1.00. Negative values indicate the particle distribution is skewed toward larger particle diameters, while positive values indicate the distribution is skewed toward smaller particle diameters.

$$\alpha_\phi = \frac{\phi_{16} + \phi_{84} - 2\phi_{50}}{2(\phi_{84} - \phi_{16})} + \frac{\phi_5 + \phi_{95} - 2\phi_{50}}{2(\phi_{95} - \phi_5)}$$

4. Kurtosis (β_ϕ) is a measure of how far the sediment distribution curve departs from a normal Gaussian shape at its peak. Curves with greater than normal amounts of sediment at their modes will be sharp or leptokurtic ($\beta_\phi > 1$). Those with fatter tails and lower peaks than expected are termed platykurtic ($\beta_\phi < 1$). $\beta_\phi = 1.00$ for a normal curve. Curve category interpretations are based on Folk (1974).

$$\beta_\phi = \frac{\phi_{95} - \phi_5}{2.44(\phi_{75} - \phi_{25})}$$

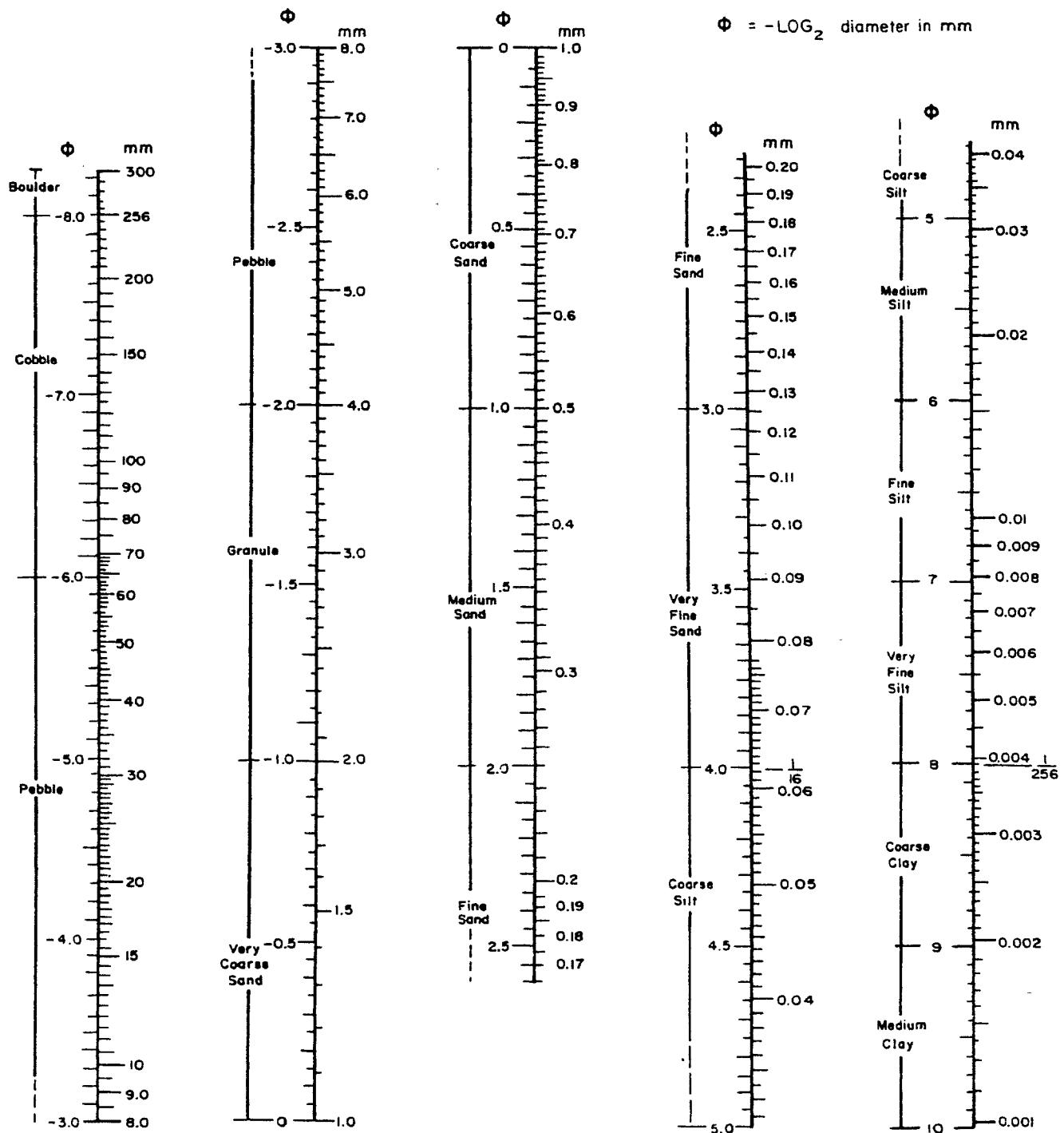
LITERATURE CITED

Folk, R. L. 1974. Petrology of sedimentary rocks. Hemphill Publishing Co., Austin, TX. 182 p.

Inman, D. L. 1952. Measures for describing the size distribution of sediments. J. Sed. Pet. 22:125-145.

Appendix B. (Cont.).

Phi - Millimeter Conversion Figure



Measurement sorting values for a large number of sediments has suggested the following verbal classification scale for sorting:

σ_1 under	.35 ϕ , .35-.50 ϕ , .50-.71 ϕ , .71-1.0 ϕ	very well sorted well sorted moderately well sorted moderately sorted	1.0-2.0 ϕ , 2.0-4.0 ϕ , over 4.0 ϕ ,	poorly sorted very poorly sorted extremely poorly sorted
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APPENDIX C

Water quality parameters at each receiving water monitoring station

Appendix C-1. Water quality parameters at each receiving water monitoring station during flood and ebb tides. Haynes and AES Alamitos L.L.C. generating stations NPDES, winter 2001.

	Depth (m)	Temp. (°C)		Oxygen (mg/l)		pH		Salinity (ppt)	
		FLOOD	EBB	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB
RW1	0	22.48	23.47	6.90	6.53	7.93	7.92	30.18	28.77
	1	19.39	18.12	7.45	7.32	7.99	8.02	31.36	31.55
	2	16.05	15.66	7.65	7.82	8.13	8.14	32.75	32.78
	3	15.33	15.25	7.88	8.66	8.14	8.13	33.06	33.08
	4	15.18	14.81	8.54	8.37	8.07	8.09	33.22	33.17
RW2	0	18.89	18.25	7.23	7.28	8.02	8.04	31.57	31.87
	1	18.54	18.21	7.30	7.32	8.03	8.05	31.76	31.85
	2	16.75	17.29	7.66	7.47	8.08	8.05	32.50	32.21
	3	15.65	15.62	7.76	7.71	8.12	8.12	32.93	32.90
	4	15.39	15.86	8.20	8.18	8.10	8.13	33.00	32.80
RW3	0	16.18	15.58	10.19	10.18	8.27	8.27	31.92	32.03
	1	16.16	15.57	10.20	10.17	8.28	8.27	31.92	32.04
	2	15.50	15.61	10.38	10.20	8.25	8.25	32.45	32.13
	3	14.80	15.23	10.45	9.99	8.18	8.19	32.90	32.64
	4	14.56	14.78	9.84	9.55	8.08	8.17	33.02	32.85
	5	14.43	14.56	9.08	9.16	8.06	8.12	33.05	33.01
RW4	6	14.24	14.33	8.16	8.42	8.03	8.05	33.12	33.12
	0	21.95	17.89	6.97	8.21	7.98	8.15	30.38	31.33
	1	19.53	16.65	7.50	8.26	8.02	8.16	31.35	31.85
	2	16.21	15.64	8.22	8.31	8.20	8.14	32.59	32.52
	3	14.96	14.96	8.28	8.56	8.15	8.09	33.01	32.94
	4	14.79	14.63	9.24	7.88	8.10	8.07	33.14	33.06
	5	14.58	14.38	8.32	7.63	8.07	8.05	33.11	33.13
	6	14.12	14.12	7.93	7.46	8.05	8.04	33.24	33.20
RW5	7	14.22	14.05	7.61	7.37	8.02	8.02	33.31	33.27
	0	19.61	19.21	8.07	7.50	8.06	8.02	31.27	31.31
	1	18.18	18.12	8.39	7.71	8.09	8.03	31.84	31.78
	2	15.56	16.06	8.93	8.01	8.15	8.09	32.78	32.54
	3	14.78	15.05	9.24	8.09	8.10	8.11	33.00	32.88
	4	14.09	14.55	9.10	8.66	8.05	8.10	33.24	33.06
	5	13.89	14.19	8.18	8.29	8.02	8.07	33.33	33.17
	6	13.93	14.00	7.31	7.78	8.01	8.04	33.32	33.30
RW6	7	14.19		7.28		8.03		33.23	
	0	16.34	15.73	12.19	9.47	8.41	8.25	31.39	31.30
	1	16.28	15.70	12.18	9.60	8.41	8.25	31.43	31.48
	2	15.78	15.67	12.37	9.48	8.38	8.22	31.82	32.12
	3	15.58	15.25	12.33	9.66	8.25	8.17	32.48	32.80
	4	15.14	15.04	11.92	9.17	8.10	8.11	32.71	32.90
RW7	0	15.52	14.53	9.78	8.57	8.23	8.14	32.50	32.92
	1	15.47	14.52	9.78	8.62	8.23	8.14	32.52	32.92
	2	15.24	14.51	9.86	8.62	8.24	8.13	32.63	32.95
	3	14.86	14.52	9.95	8.62	8.28	8.11	32.90	32.98
	4	14.66	14.52	10.23	8.49	8.19	8.10	32.95	32.98
	5	14.61	14.53	10.27	8.31	8.14	8.10	32.95	32.99
	6	14.55	14.51	9.40	8.30	8.13	8.10	32.95	33.00
	7	14.46	14.29	8.98	8.29	8.10	8.08	33.00	33.05
	8	14.30	14.19	8.64	8.05	8.07	8.06	33.06	33.10
	9	14.02	14.06	8.43	7.81	8.04	8.04	33.15	33.14
	10	13.85	13.80	7.99	7.63	8.01	8.01	33.23	33.26
	11	13.76	13.73	7.52	7.28	7.99	7.99	33.28	33.29
	12	13.74	13.72	7.25	6.88	7.98	7.98	33.30	33.29
	13	13.73	13.73	6.99	6.70	7.98	7.98	33.31	33.30

Appendix C-1. (Cont.).

	Depth (m)	Temp. (°C)		Oxygen (mg/l)		pH		Salinity (ppt)	
		FLOOD	EBB	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB
RW8	0	15.37	15.33	9.36	9.10	8.21	8.21	32.78	32.21
	1	15.35	15.32	9.33	9.11	8.22	8.21	32.77	32.22
	2	15.23	15.22	9.38	9.14	8.22	8.21	32.77	32.32
	3	15.06	15.02	9.46	9.17	8.24	8.21	32.80	32.63
	4	14.93	14.59	9.57	9.41	8.24	8.16	32.81	32.88
	5	14.82	14.54	9.71	9.09	8.22	8.14	32.86	32.93
	6	14.70	14.43	9.84	8.65	8.19	8.11	32.91	33.00
	7	14.58	14.23	9.69	8.52	8.15	8.07	32.93	33.08
	8	14.43	13.91	9.19	8.15	8.12	8.04	33.01	33.21
	9	14.09	13.77	8.91	7.70	8.06	8.02	33.14	33.30
	10	13.79	13.72	8.59	7.21	8.01	8.01	33.28	33.33
	11	13.74	13.74	8.06	7.00	8.00	8.00	33.32	33.32
	12	13.68	13.64	7.54	7.04	8.00	8.00	33.37	33.39
	13	13.78	13.64	7.18	6.94	8.00	8.00	33.30	33.39
RW9	0	16.44	17.20	9.71	9.61	8.23	8.23	32.18	31.98
	1	15.93	16.19	9.83	10.30	8.24	8.24	32.44	32.31
	2	15.55	14.79	9.82	10.52	8.25	8.19	32.60	32.83
	3	15.33	14.58	9.97	9.54	8.24	8.17	32.66	32.90
	4	15.01	14.54	10.13	9.16	8.25	8.14	32.68	32.97
	5	14.67	14.46	10.27	8.93	8.18	8.11	32.87	33.01
	6	14.38	14.23	9.89	8.67	8.11	8.08	33.02	33.11
	7	14.35	13.87	8.50	8.42	8.08	8.05	33.03	33.27
	8	14.24	13.82	8.20	7.88	8.06	8.04	33.08	33.34
	9	13.94	13.86	8.00	7.38	8.03	8.04	33.21	33.36
	10	13.74	13.90	7.51	7.44	8.01	8.05	33.33	33.36
	11	13.69	13.81	7.20	7.58	8.00	8.06	33.36	33.38
	12	13.68	13.67	7.08	7.60	8.00	8.04	33.38	33.43
	13	13.61	13.65	7.09	7.31	7.99	8.02	33.42	33.42
RW10	0	22.10	22.70	9.40	6.30	7.72	7.65	4.00	5.00
	1	24.70	22.20	6.20	4.50	7.73	7.64	18.00	23.00
RW11	0	24.70	24.10	6.00	5.60	7.93	7.89	N.C.	N.C.
	1	25.00	23.80	6.10	6.10	7.93	7.87	N.C.	N.C.
	2	23.80	22.30	5.90	5.90	7.90	7.82	N.C.	N.C.
RW12	0	26.40	23.30	5.20	6.10	7.83	7.78	N.C.	N.C.
	1	25.70	23.70	5.90	6.10	7.90	7.78	34.00	23.00
	2	26.00	23.40	5.60	5.90	7.90	7.86	N.C.	N.C.
	3	24.70	23.80	5.80	6.10	7.94	7.88	N.C.	N.C.

N.C. = data not collected

Appendix C-2. Water quality parameters at each receiving water monitoring station during flood and ebb tides. Haynes and AES Alamitos L.L.C. generating stations NPDES, summer 2001.

	Depth (m)	Temp. (°C)		Oxygen (mg/l)		pH		Salinity (ppt)	
		FLOOD	EBB	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB
RW1	0	20.23	22.64	6.67	6.36	7.91	7.79	33.15	32.94
	1	20.09	21.23	6.71	6.33	7.92	7.85	33.20	33.31
	2	19.61	19.57	6.76	5.98	7.91	7.96	33.29	33.56
	3	18.56	19.31	6.88	7.10	7.93	7.98	33.51	33.51
	4	18.53	19.19	6.90	7.50	7.93	7.98	33.52	33.50
	5	18.55	19.16	6.92	7.28	7.93	7.96	33.52	33.49
	6		19.06		7.07		7.95		33.60
RW2	0	19.47	19.77	6.86	7.17	7.93	7.96	33.50	33.50
	1	19.45	19.66	6.85	7.18	7.93	7.96	33.50	33.52
	2	19.39	19.52	6.86	7.22	7.94	7.97	33.50	33.54
	3	19.35	19.46	6.90	7.22	7.93	7.97	33.50	33.53
	4	19.27	19.40	6.92	7.24	7.93	7.97	33.49	33.52
	5	18.96	19.38	6.98	7.25	7.94	7.96	33.52	33.51
RW3	0	20.12	20.17	7.16	7.24	7.97	7.96	33.11	33.28
	1	20.00	19.88	7.07	7.27	7.98	7.96	33.14	33.41
	2	18.95	18.95	7.29	7.46	8.00	7.96	33.33	33.63
	3	18.34	18.40	7.55	7.47	7.99	7.96	33.44	33.52
	4	18.19	18.29	7.57	7.36	7.97	7.97	33.45	33.47
	5	18.07	18.23	7.37	7.50	7.97	7.97	33.45	33.46
	6	17.53	17.59	7.33	7.64	7.96	7.95	33.47	33.54
	7	17.24	17.23	7.20	7.17	7.93	7.91	33.51	33.53
	8	17.51		6.81		7.94		33.51	
RW4	0	20.22	22.71	6.84	6.52	7.92	7.89	33.08	32.56
	1	19.78	20.46	6.89	6.67	7.93	7.92	33.27	33.32
	2	18.83	19.66	6.96	6.73	7.95	7.97	33.43	33.55
	3	18.24	19.39	7.17	7.23	7.95	7.97	33.49	33.53
	4	18.02	18.70	7.01	7.25	7.95	7.97	33.48	33.52
	5	17.86	18.16	7.08	7.24	7.95	7.95	33.47	33.52
	6	17.45	17.58	7.18	7.12	7.94	7.94	33.47	33.53
	7	17.30	17.26	7.05	6.91	7.92	7.92	33.52	33.60
	8		17.20		6.80		7.91		33.59
RW5	0	19.45	19.50	6.97	7.09	7.93	7.97	33.45	33.54
	1	19.45	19.35	6.95	7.07	7.93	7.97	33.44	33.55
	2	19.37	18.86	6.98	7.29	7.93	7.96	33.47	33.57
	3	19.32	18.70	7.01	7.23	7.94	7.95	33.46	33.55
	4	18.78	18.53	7.13	7.22	7.95	7.96	33.45	33.56
	5	18.37	18.19	7.27	7.23	7.94	7.95	33.50	33.58
	6	18.29	17.97	7.13	7.16	7.93	7.95	33.51	33.53
	7	18.27	17.80	6.96	7.15	7.93	7.95	33.50	33.56
	8	18.27		6.94		7.93		33.50	
RW6	0	19.41	19.86	7.22	7.35	7.98	7.97	33.38	33.35
	1	19.26	19.86	7.31	7.32	7.99	7.96	33.42	33.35
	2	19.11	19.77	7.33	7.41	7.99	7.97	33.43	33.36
	3	19.10	19.58	7.22	7.44	7.99	7.97	33.43	33.38
	4	19.07	18.59	7.18	7.68	7.99	7.97	33.43	33.51
	5	18.96	18.09	7.21	7.65	7.98	7.94	33.44	33.49

Appendix C-2. (Cont.).

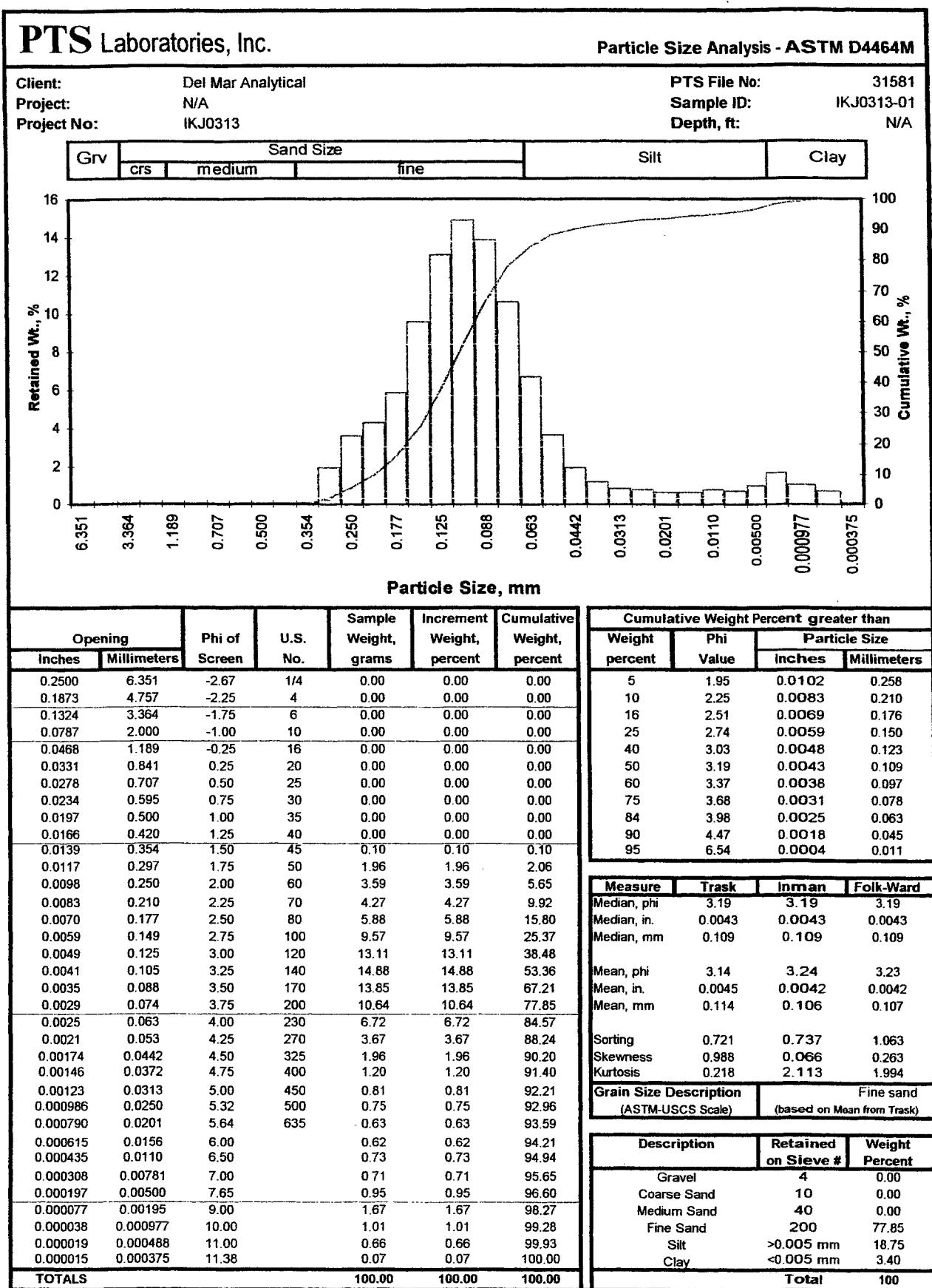
	Depth (m)	Temp. (°C)		Oxygen (mg/l)		pH		Salinity (ppt)	
		FLOOD	EBB	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB
RW7	0	20.08	20.23	7.07	7.41	7.96	7.96	33.04	33.16
	1	19.81	20.15	7.15	7.39	7.96	7.96	33.13	33.18
	2	19.50	19.82	7.15	7.46	7.97	7.98	33.21	33.20
	3	19.34	19.20	7.17	7.60	7.98	7.99	33.28	33.31
	4	19.35	18.88	7.23	7.66	7.99	7.99	33.29	33.36
	5	19.32	18.36	7.30	7.75	7.99	7.98	33.31	33.39
	6	19.20	17.39	7.38	7.63	7.99	7.94	33.31	33.44
	7	19.13	16.58	7.33	7.24	7.99	7.92	33.30	33.47
	8	18.58	16.23	7.33	6.97	7.99	7.90	33.38	33.50
	9	16.75	16.19	7.57	6.70	7.95	7.89	33.48	33.50
	10	16.25	16.16	7.04	6.71	7.92	7.88	33.51	33.49
	11	16.25	16.16	6.82	6.58	7.92	7.88	33.50	33.49
	12	16.25	16.16	6.84	6.55	7.93	7.88	33.50	33.49
	13	16.26	16.15	6.84	6.54	7.92	7.88	33.49	33.49
	14	16.26	16.17	6.84	6.50	7.92	7.88	33.50	33.48
RW8	0	18.51	19.60	7.06	7.39	7.95	7.96	33.40	33.45
	1	18.35	19.56	7.12	7.42	7.95	7.97	33.41	33.44
	2	18.30	19.43	7.09	7.43	7.95	7.97	33.43	33.45
	3	18.24	19.19	7.07	7.51	7.96	7.98	33.48	33.46
	4	18.12	19.09	7.21	7.57	7.97	7.99	33.50	33.46
	5	17.98	18.96	7.30	7.64	7.97	7.99	33.51	33.45
	6	17.89	18.82	7.29	7.67	7.95	7.99	33.49	33.45
	7	17.61	18.64	7.27	7.76	7.95	7.99	33.47	33.45
	8	17.39	18.61	7.14	7.58	7.95	7.98	33.51	33.45
	9	16.70	18.54	7.22	7.53	7.93	7.98	33.54	33.47
	10	16.33	18.02	7.07	7.63	7.90	7.97	33.49	33.51
	11	16.19	17.63	6.73	7.50	7.88	7.96	33.51	33.59
	12	16.14	16.90	6.43	7.44	7.88	7.92	33.50	33.55
	13	16.11	16.47	6.44	6.95	7.88	7.89	33.49	33.53
	14	16.10	16.45	6.48	6.62	7.88	7.88	33.49	33.56
RW9	0	19.10	19.52	7.12	7.38	7.93	7.97	33.40	33.50
	1	18.78	19.43	7.21	7.38	7.94	7.97	33.44	33.54
	2	18.59	19.16	7.21	7.44	7.95	7.98	33.44	33.50
	3	18.45	19.15	7.28	7.46	7.96	7.97	33.47	33.52
	4	18.01	19.11	7.41	7.40	7.95	7.97	33.52	33.52
	5	17.67	19.01	7.39	7.30	7.94	7.97	33.48	33.53
	6	17.54	18.74	7.25	7.31	7.93	7.97	33.54	33.51
	7	17.29	18.22	7.20	7.42	7.93	7.96	33.54	33.48
	8	17.01	17.74	7.21	7.42	7.93	7.95	33.53	33.47
	9	16.82	17.33	7.06	7.27	7.91	7.95	33.51	33.51
	10	16.75	17.17	6.85	7.17	7.90	7.94	33.51	33.51
	11	16.58	16.95	6.80	7.07	7.90	7.94	33.55	33.51
	12	16.44	16.56	6.73	7.20	7.89	7.92	33.52	33.50
	13	16.42	16.24	6.67	6.72	7.88	7.90	33.50	33.50
	14	16.43	16.08	6.44	6.57	7.87	7.90	33.51	33.50
RW10	0	25.93	28.77	3.44	3.30	7.51	7.47	22.73	18.44
	1	26.57	28.03	4.76	3.96	7.71	7.67	32.80	32.10
	2	26.68		4.86		7.76		33.00	
RW11	0	24.52	29.11	5.06	5.25	7.78	7.78	33.61	32.72
	1	25.59	28.33	5.12	5.46	7.78	7.80	33.63	32.80
	2	25.09	28.32	5.06	5.43	7.80	7.79	33.61	32.83
	3	25.86		5.24		7.80		33.61	
RW12	0	23.55	28.24	5.25	5.32	7.59	7.79	33.08	32.98
	1	23.76	28.11	5.24	5.44	7.71	7.80	33.18	32.90
	2	23.78	28.05	5.23	5.47	7.74	7.79	33.19	32.83
	3	23.78	28.00	5.29	5.49	7.75	7.79	33.19	32.81

APPENDIX D

Sediment grain size distribution and statistical parameters by station

Appendix D. Sediment grain size distribution and statistical parameters by station. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Station B1



Appendix D. (Cont.).

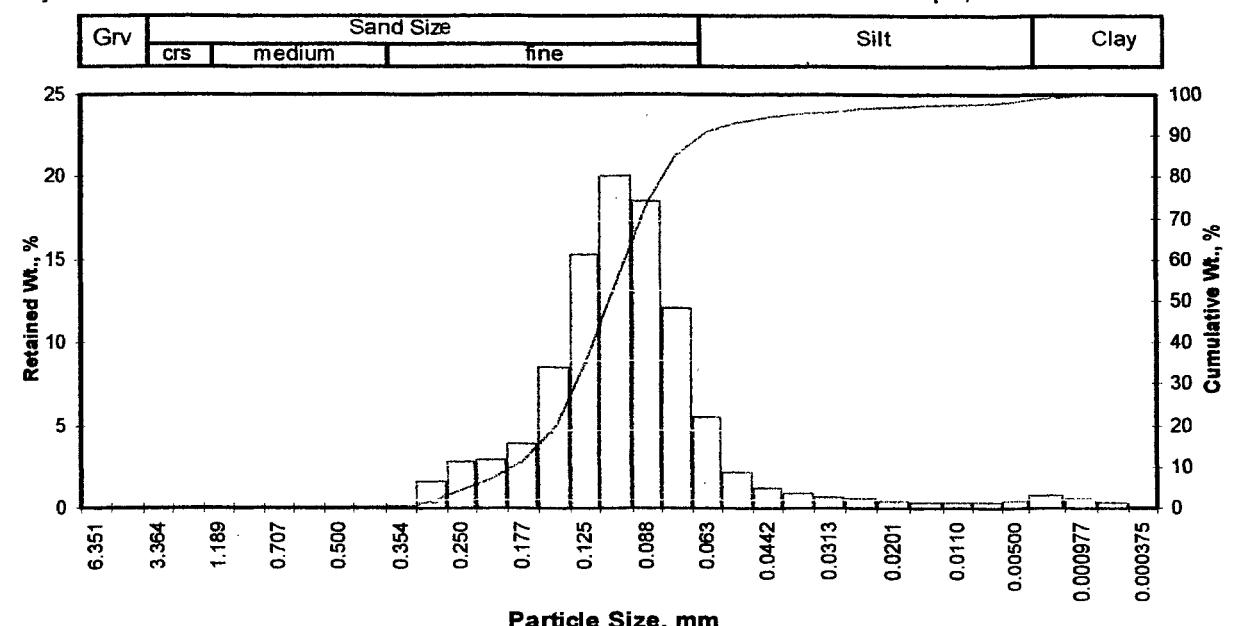
Station B2

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client: Del Mar Analytical
 Project: N/A
 Project No: IKJ0313

PTS File No: 31581
 Sample ID: IKJ0313-02
 Depth, ft: N/A



Opening		Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
Inches	Millimeters					
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	18	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.09	0.09	0.09
0.0117	0.297	1.75	50	1.60	1.60	1.69
0.0098	0.250	2.00	60	2.77	2.77	4.46
0.0083	0.210	2.25	70	2.87	2.87	7.32
0.0070	0.177	2.50	80	3.91	3.91	11.23
0.0059	0.149	2.75	100	8.49	8.49	19.72
0.0049	0.125	3.00	120	15.26	15.26	34.98
0.0041	0.105	3.25	140	20.02	20.02	55.00
0.0035	0.088	3.50	170	18.51	18.51	73.50
0.0029	0.074	3.75	200	12.02	12.02	85.52
0.0025	0.063	4.00	230	5.52	5.52	91.04
0.0021	0.053	4.25	270	2.18	2.18	93.22
0.00174	0.0442	4.50	325	1.18	1.18	94.40
0.00146	0.0372	4.75	400	0.87	0.87	95.26
0.00123	0.0313	5.00	450	0.63	0.62	95.89
0.000986	0.0250	5.32	500	0.57	0.57	96.46
0.000790	0.0201	5.64	635	0.42	0.42	96.87
0.000615	0.0156	6.00		0.36	0.36	97.23
0.000435	0.0110	6.50		0.37	0.37	97.60
0.000308	0.00781	7.00		0.33	0.32	97.92
0.000197	0.00500	7.65		0.40	0.40	98.32
0.000077	0.00195	9.00		0.76	0.76	99.08
0.000038	0.000977	10.00		0.55	0.54	99.62
0.000019	0.000488	11.00		0.35	0.34	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				100.00	100.00	100.00

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size	
		Inches	Millimeters
5	2.05	0.0095	0.242
10	2.42	0.0074	0.187
16	2.64	0.0063	0.160
25	2.84	0.0055	0.140
40	3.06	0.0047	0.120
50	3.19	0.0043	0.110
60	3.32	0.0039	0.100
75	3.53	0.0034	0.086
84	3.72	0.0030	0.076
90	3.95	0.0025	0.065
95	4.67	0.0015	0.039

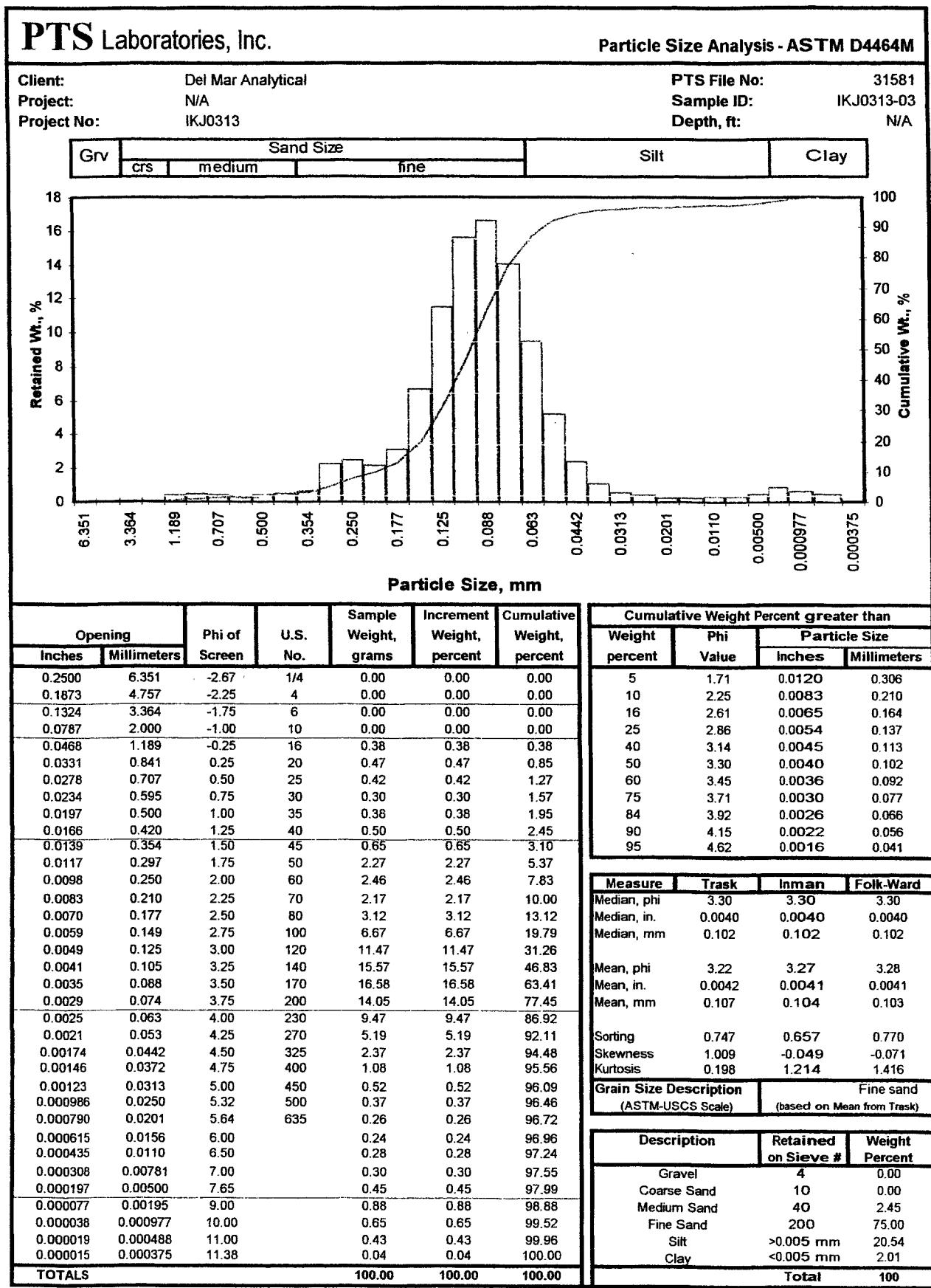
Measure	Trask	Inman	Folk-Ward
Median, phi	3.19	3.19	3.19
Median, in.	0.0043	0.0043	0.0043
Median, mm	0.110	0.110	0.110
Mean, phi	3.14	3.18	3.18
Mean, in.	0.0045	0.0043	0.0043
Mean, mm	0.113	0.110	0.110
Sorting	0.786	0.539	0.667
Skewness	1.003	-0.015	0.058
Kurtosis	0.219	1.436	1.549

Grain Size Description Fine sand (ASTM-USCS Scale) (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	85.52
Silt	>0.005 mm	12.80
Clay	<0.005 mm	1.68
Total		100

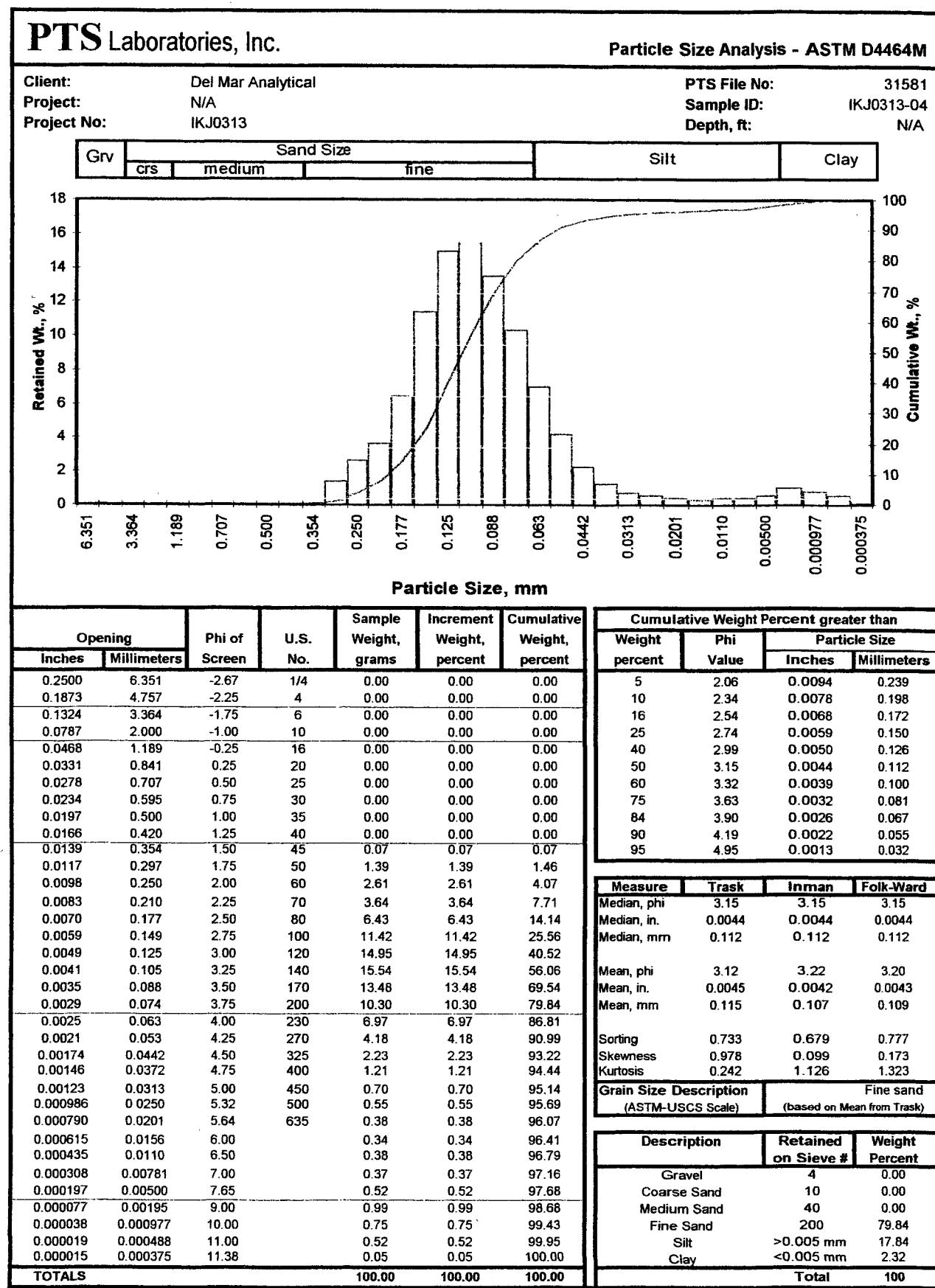
Appendix D. (Cont.).

Station B3



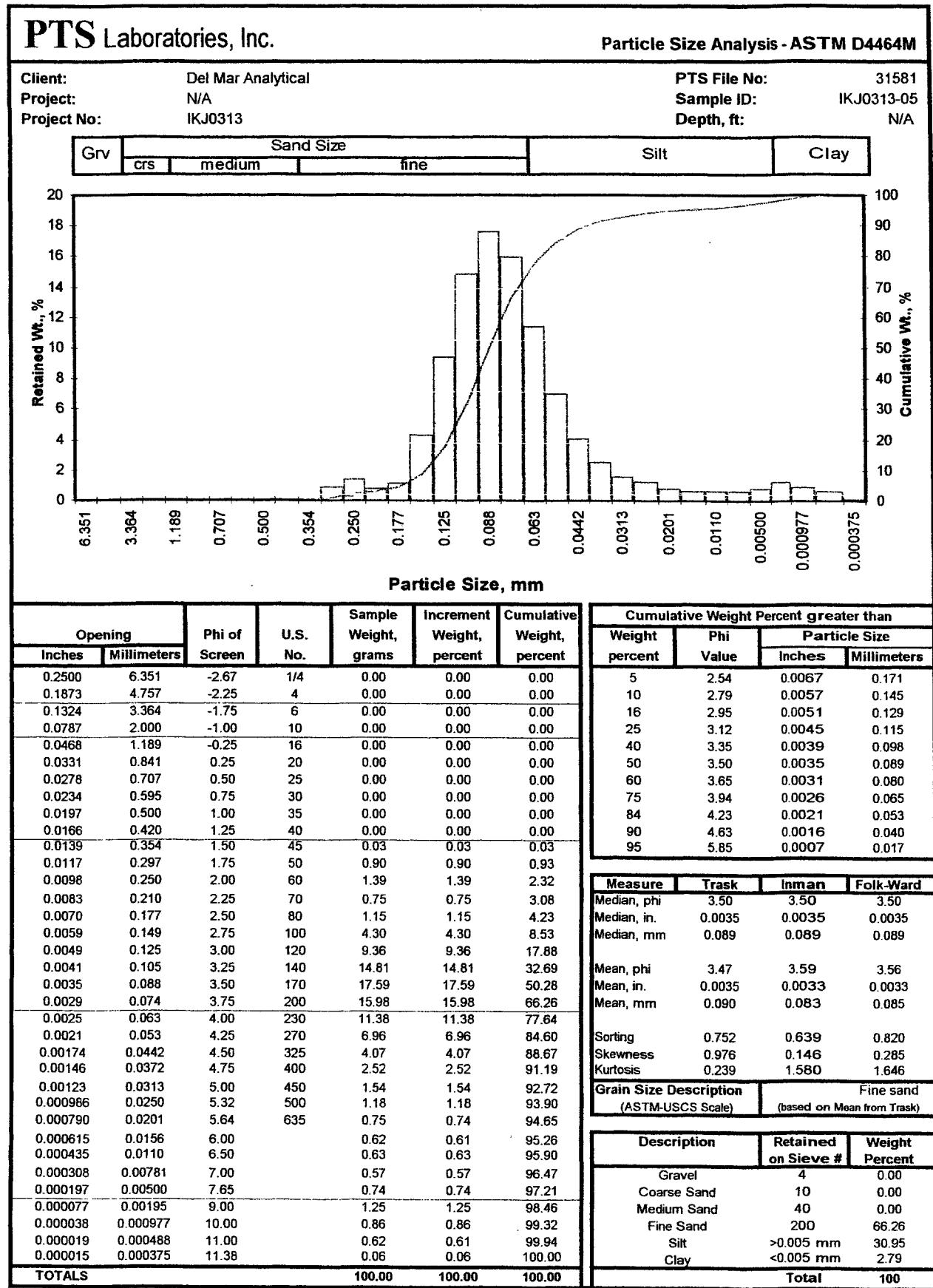
Appendix D. (Cont.).

Station B4



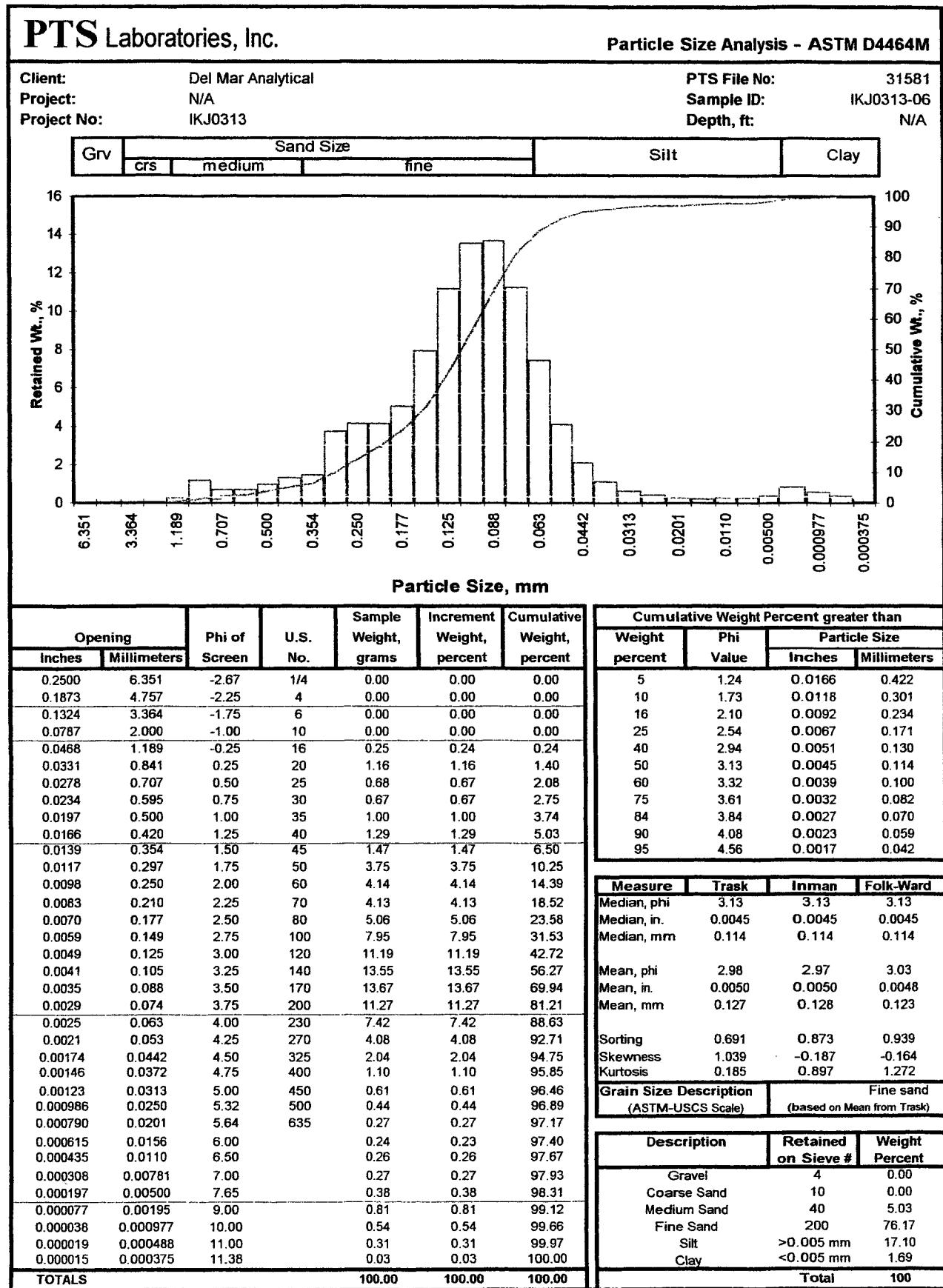
Appendix D. (Cont.).

Station B5



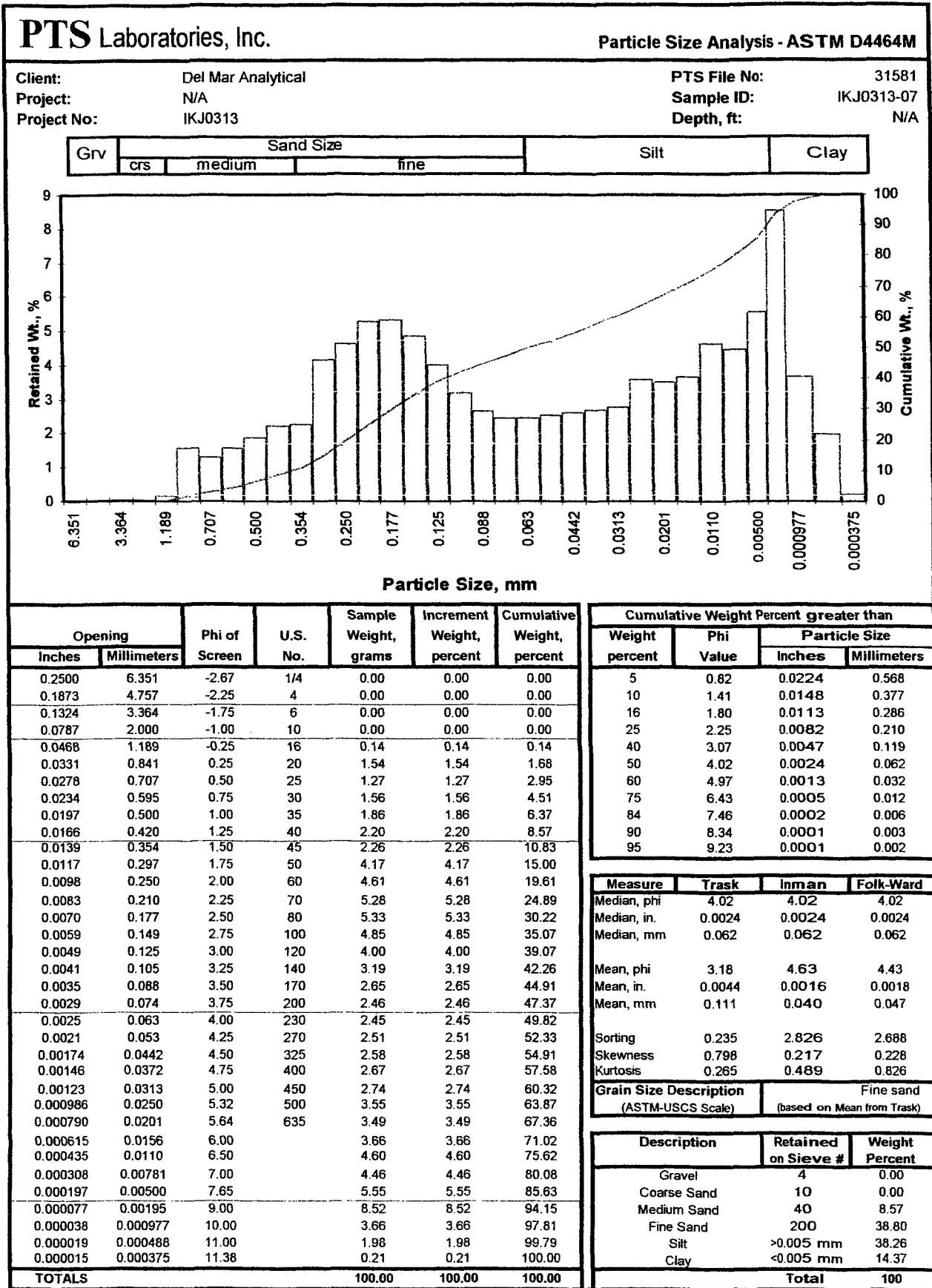
Appendix D. (Cont.).

Station B6



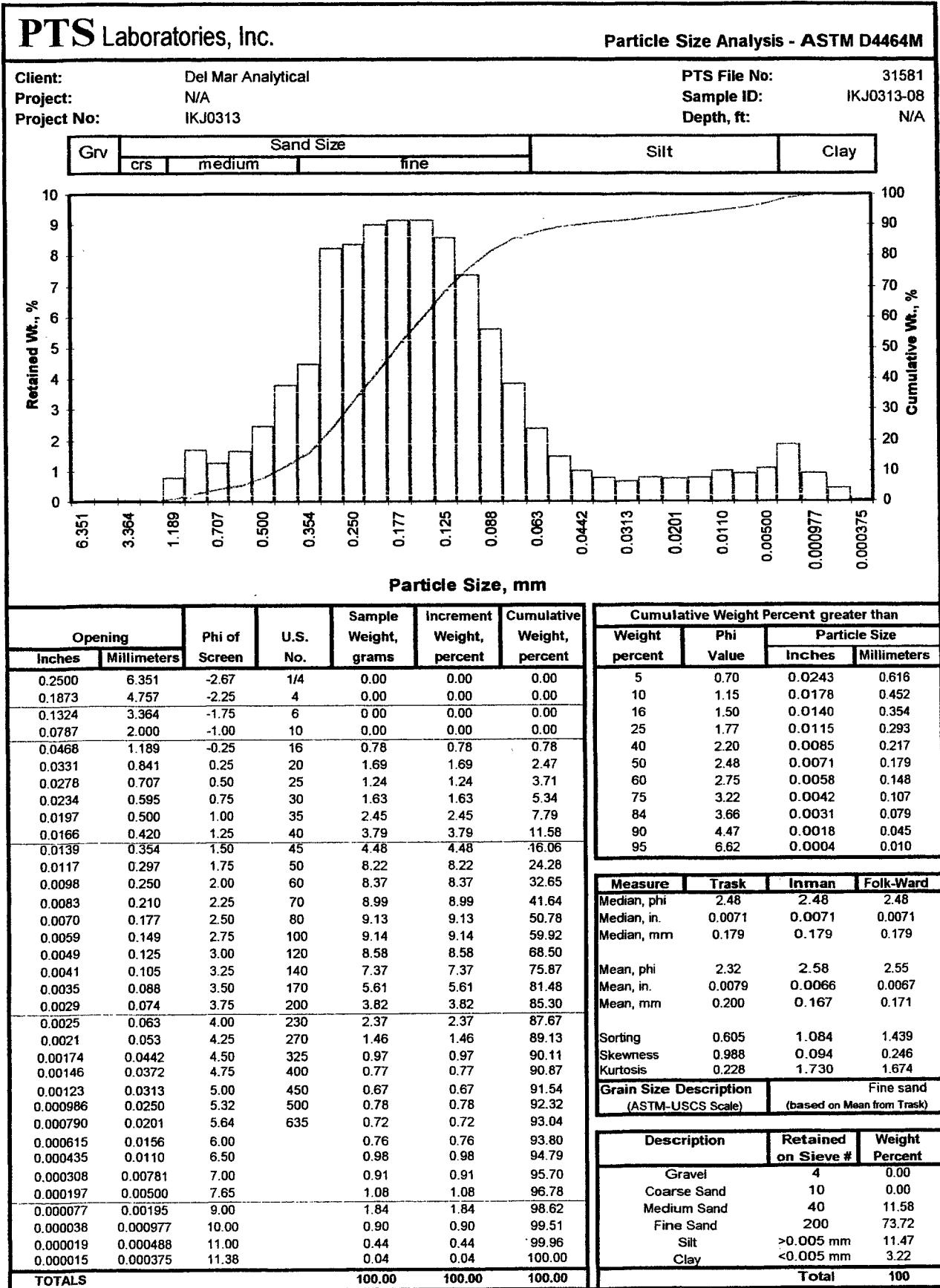
Appendix D. (Cont.).

Station B7



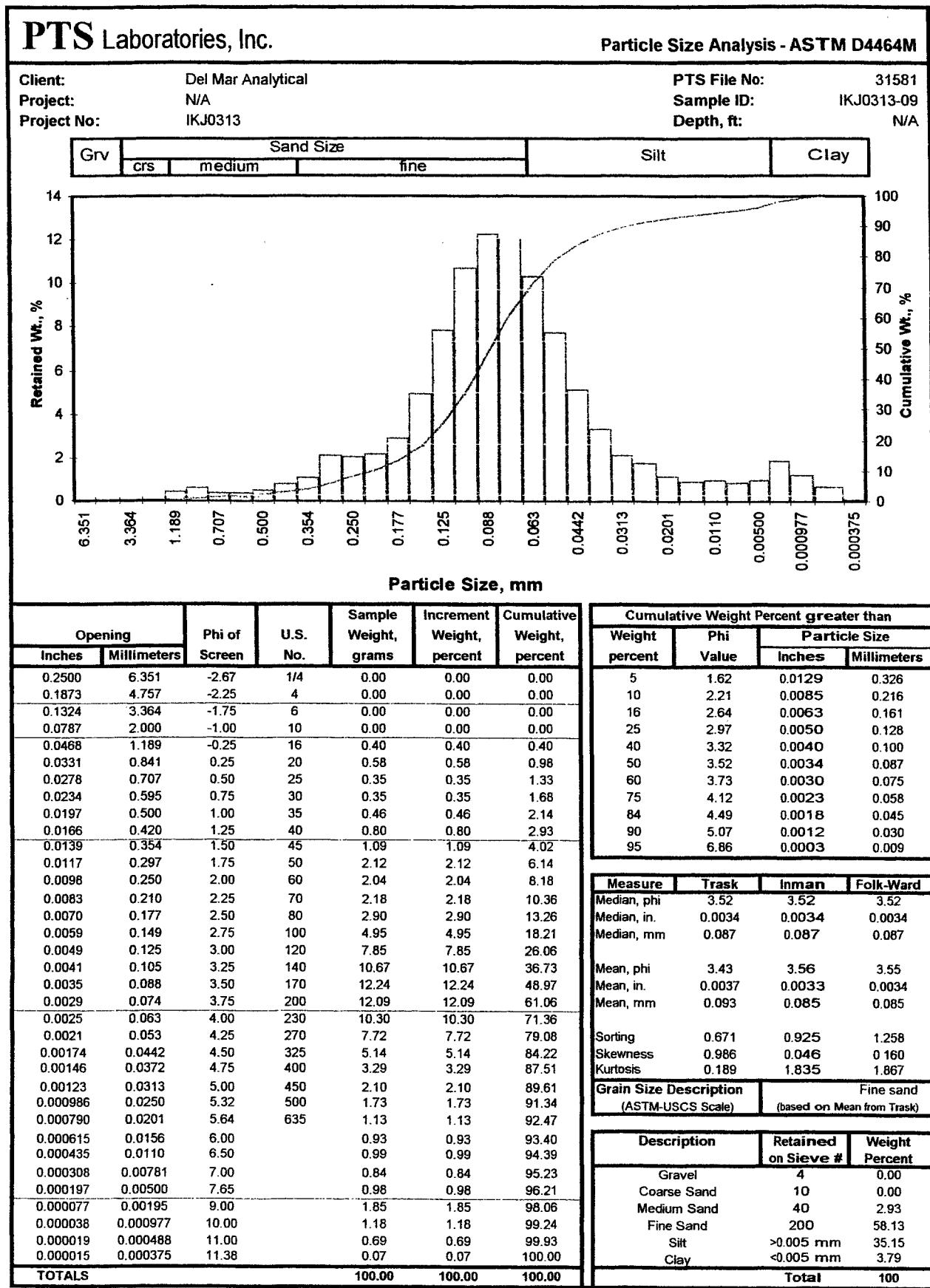
Appendix D. (Cont.).

Station B8



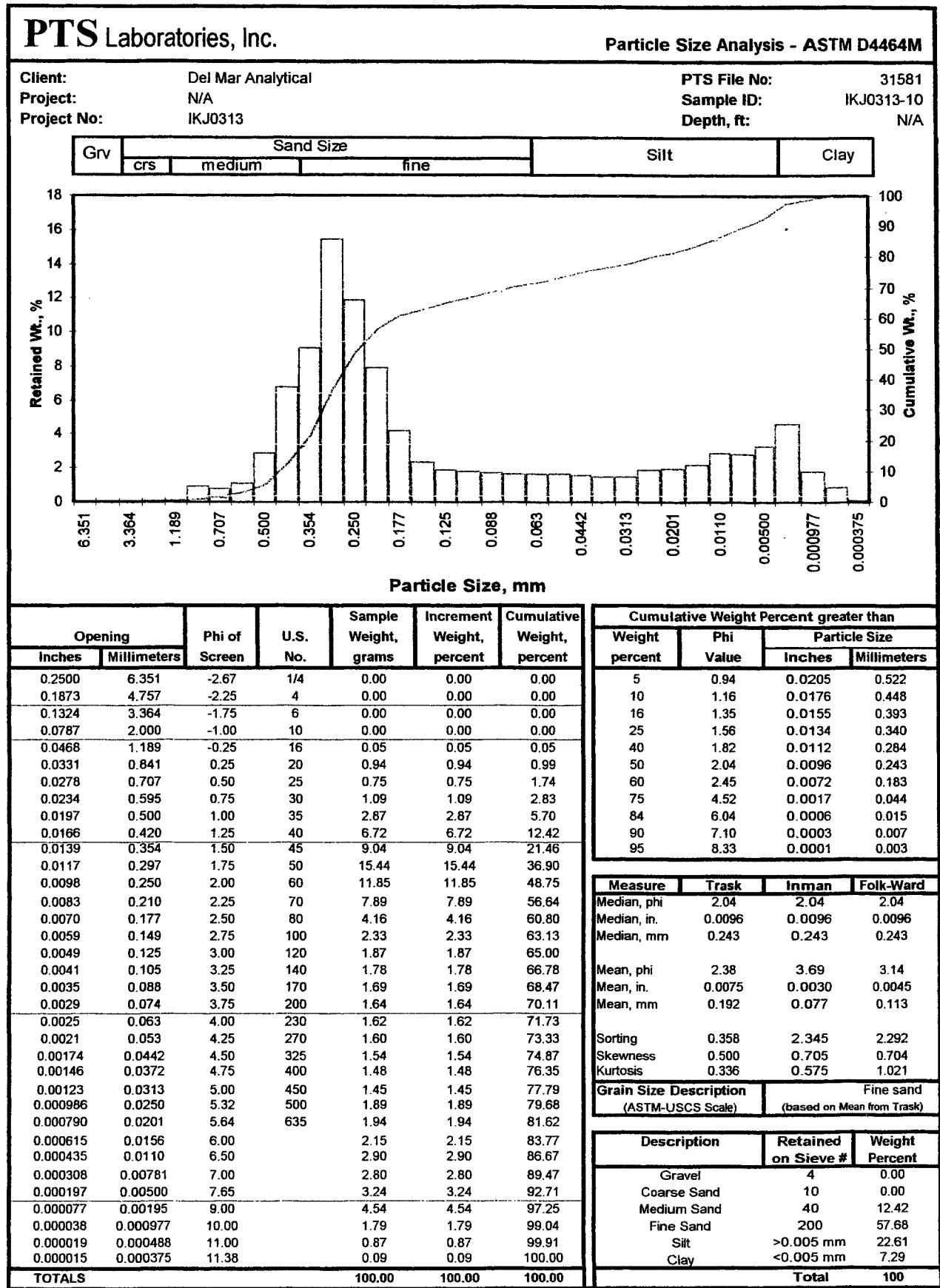
Appendix D. (Cont.).

Station B9



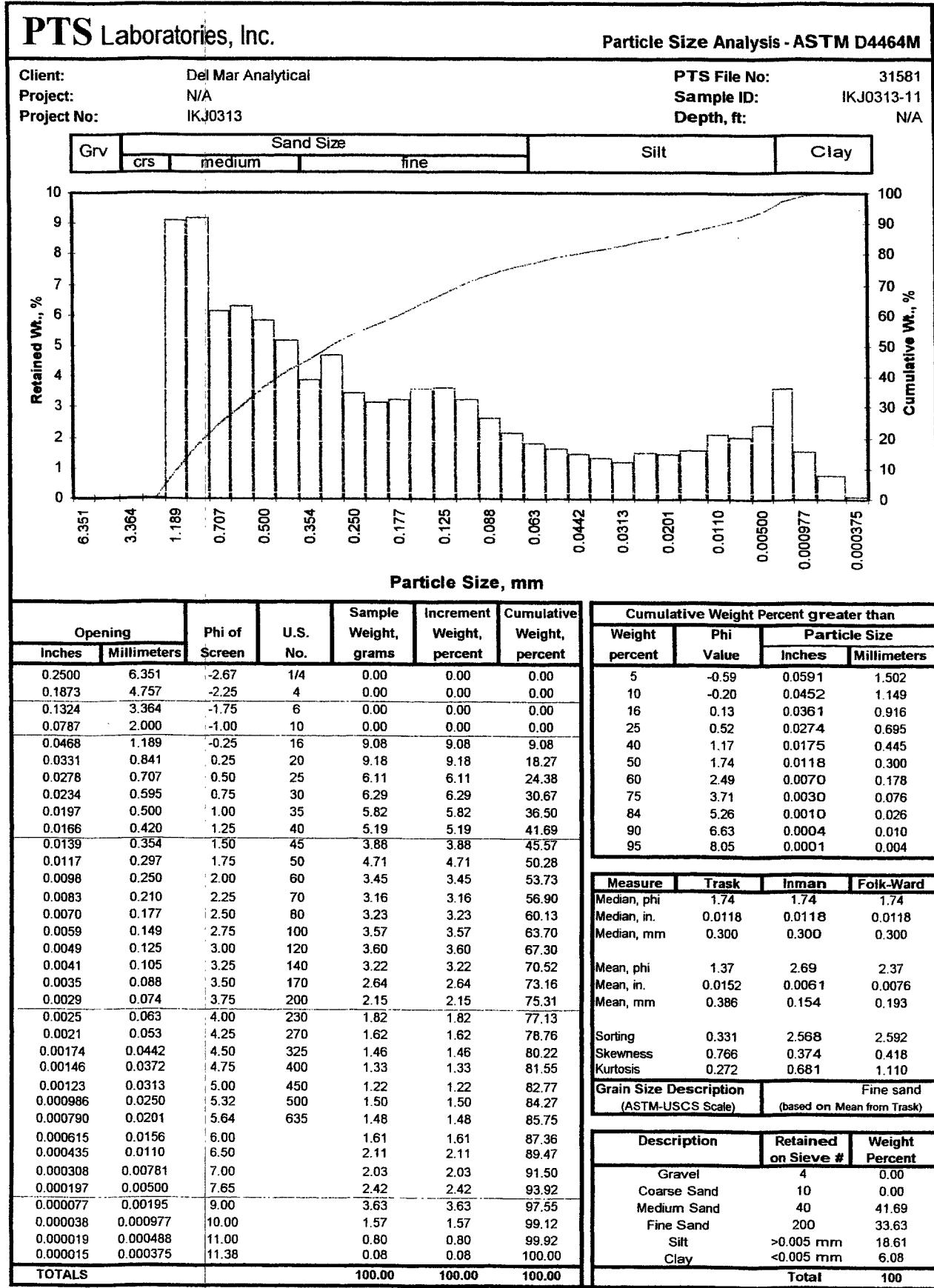
Appendix D. (Cont.).

Station B10



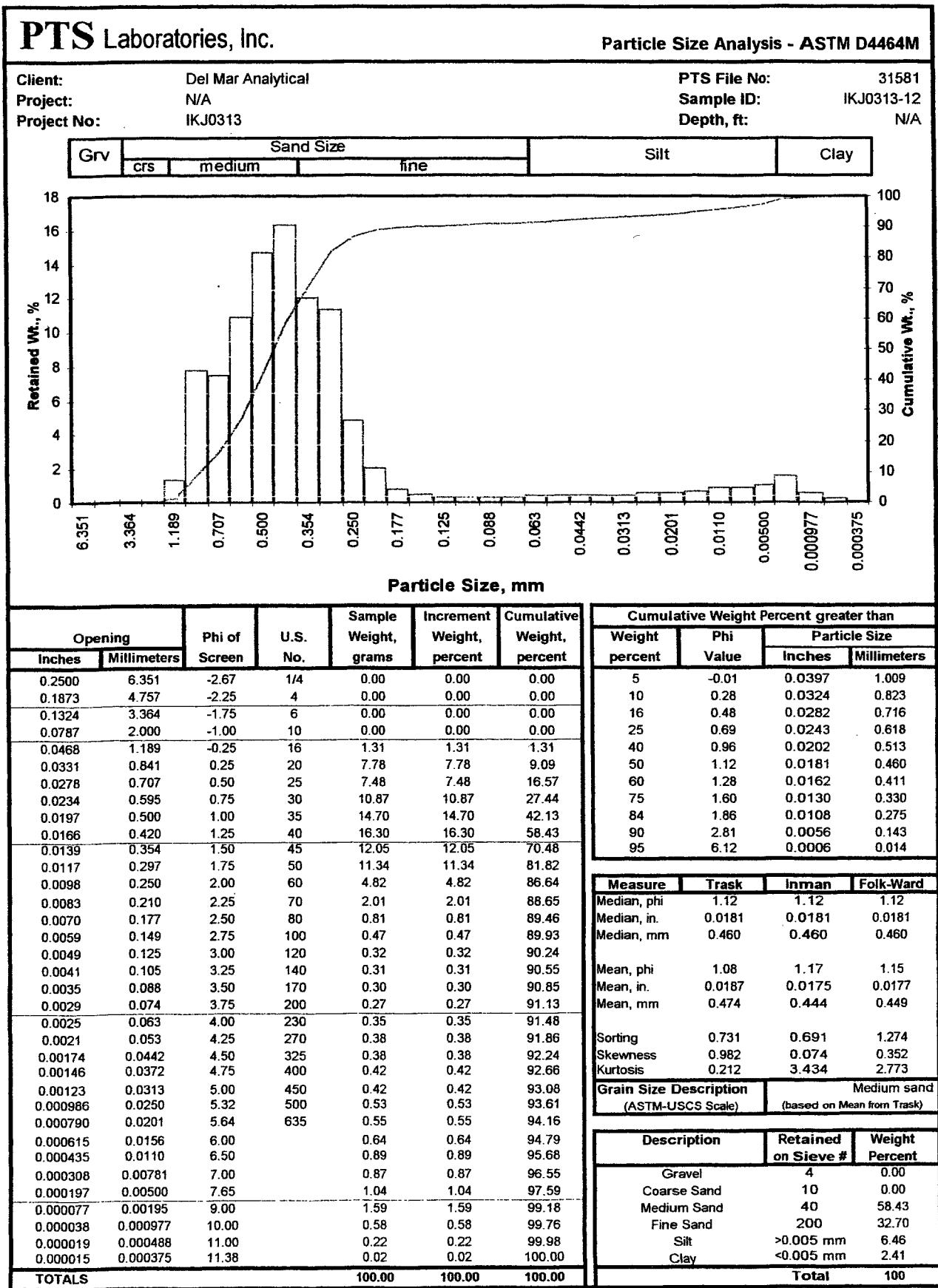
Appendix D. (Cont.).

Station B11



Appendix D. (Cont.).

Station B12



Appendix D-1. Yearly grain size values, 1978-2001. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Year	Season	Station	Mean grain size								
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	phi	μm	Sorting	Skewness	Kurtosis
2001		B1	0.00	84.6	12.0	3.4	3.23	107	1.06	0.26	1.99
		B2	0.00	91.0	7.3	1.7	3.18	110	0.67	0.06	1.55
		B3	0.00	86.9	11.1	2.0	3.28	103	0.77	-0.07	1.42
		B4	0.00	86.8	10.9	2.3	3.20	109	0.78	0.17	1.32
		B5	0.00	77.6	19.6	2.8	3.56	85	0.82	0.29	1.65
		B6	0.00	88.6	9.7	1.7	3.03	123	0.94	-0.16	1.27
		B7	0.00	49.8	35.8	14.4	4.43	47	2.69	0.23	0.83
		B8	0.00	87.7	9.1	3.2	2.55	171	1.44	0.25	1.67
		B9	0.00	71.4	24.9	3.8	3.55	85	1.26	0.16	1.87
2000		B1	0.00	70.08	26.33	3.59	3.64	80	1.25	0.31	1.60
		B2	0.00	91.18	7.31	1.51	3.27	104	0.54	0.17	1.43
		B3	0.00	75.47	22.29	2.24	3.54	86	0.91	0.07	1.63
		B4	0.00	89.22	8.98	1.80	2.97	128	0.85	0.20	1.34
		B5	0.00	89.23	9.13	1.64	3.00	125	0.89	0.08	1.56
		B6	0.00	88.41	10.07	1.52	2.76	148	1.31	-0.35	1.12
		B7	0.00	53.11	39.09	7.80	4.07	60	2.14	0.25	0.97
		B8	0.00	77.86	19.27	2.87	2.88	135	1.69	0.11	1.20
		B9	0.00	72.48	24.64	2.88	3.49	89	1.26	0.06	1.72
1999	Summer	B1	0.00	83.71	13.53	2.76	3.30	101	0.94	0.26	1.80
		B2	0.00	91.93	6.43	1.64	3.24	106	0.55	0.12	1.41
		B3	0.00	73.43	23.04	3.53	3.55	86	1.33	0.13	2.21
		B4	0.00	79.20	18.00	2.80	3.38	96	1.02	0.26	1.59
		B5	0.00	80.08	17.62	2.30	3.50	88	0.78	0.19	1.58
		B6	0.00	90.28	8.48	1.24	2.45	183	1.53	-0.47	0.82
		B7	0.00	33.06	52.96	13.98	5.01	31	2.46	-0.08	0.88
		B8	0.00	91.89	6.56	1.55	2.48	179	1.03	0.14	1.25
		B9	0.00	73.07	22.81	4.12	3.25	105	1.84	0.13	1.42
1996	Summer	B1	0.00	86.60	11.71	1.70	3.34	98.76	61.35	0.20	1.26
		B2	0.00	96.39	3.50	0.12	3.28	102.95	78.62	0.02	1.42
		B3	0.00	61.58	36.11	2.31	3.90	66.99	61.51	0.07	1.17
		B4	0.00	84.42	12.81	2.77	3.45	91.51	59.78	0.28	1.36
		B5	-	-	-	-	-	-	-	-	
		B6	-	-	-	-	-	-	-	-	
		B7	-	-	-	-	-	-	-	-	
		B8	-	-	-	-	-	-	-	-	
		B9	-	-	-	-	-	-	-	-	
1997	Summer	B1	0.00	80.92	15.69	3.40	3.81	71.00	64.78	0.23	2.17
		B2	0.01	94.59	4.19	1.21	3.47	90.00	81.29	0.10	1.07
		B3	0.00	69.44	28.63	1.93	3.87	68.00	63.84	0.13	1.33
		B4	0.00	72.18	25.71	2.11	3.82	71.00	61.86	0.20	1.40
		B5	0.33	98.87	0.70	0.09	1.26	420.00	67.41	0.06	1.90
		B6	0.00	84.06	14.37	1.57	3.61	82.00	65.59	-0.25	1.84
		B7	0.00	69.26	18.77	11.96	3.90	67.00	33.15	0.53	1.34
		B8	0.00	89.68	8.69	1.63	3.02	124.00	54.36	0.13	1.07
		B9	0.00	68.53	28.28	3.19	3.79	72.00	50.81	0.01	1.77
1994	Summer	B1	0.00	62.73	35.76	1.51	3.97	63.81	67.08	0.08	0.97
		B2	0.47	96.86	2.66	0.02	3.31	100.83	80.68	-0.11	1.37
		B3	0.00	61.04	36.81	2.15	4.05	60.37	65.43	0.28	1.53
		B4	0.00	70.79	27.75	1.46	3.90	66.99	64.30	0.24	1.68
		B5	0.00	83.51	15.74	0.74	3.52	87.17	64.69	-0.33	1.90
		B6	0.00	85.41	14.21	0.38	3.35	98.07	62.52	-0.54	1.78
		B7	0.00	57.28	30.79	11.94	4.53	43.28	33.41	0.49	1.20
		B8	0.00	44.26	54.27	1.47	3.71	76.42	57.94	-0.63	1.01
		B9	0.00	72.88	25.37	1.74	3.27	103.66	44.93	-0.23	0.90
1993	Summer	B1	0.00	54.82	42.13	3.05	4.19	54.79	60.62	0.28	1.95
		B2	0.00	92.63	7.14	0.23	3.66	79.11	82.18	-0.16	1.05
		B3	0.00	62.87	36.02	1.11	3.90	66.99	65.89	-0.01	1.21
		B4	0.00	72.57	24.79	2.64	3.85	69.35	63.06	0.19	1.52
		B5	0.00	80.25	17.64	2.11	3.87	68.39	69.23	0.14	2.70
		B6	0.00	84.96	14.27	0.78	3.43	92.78	61.89	-0.48	1.92
		B7	0.00	34.16	50.08	15.76	5.33	24.86	30.15	0.36	1.41
		B8	0.00	58.60	37.62	3.78	3.92	66.06	47.11	-0.02	1.42
		B9	0.00	43.25	50.18	6.58	4.73	37.68	43.00	0.40	1.95

Appendix D-1. (Cont.).

Year	Season	Station	Mean grain size								
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	phi	μm	Sorting	Skewness	Kurtosis
1992	Summer	B1	0.00	92.04	7.96	0.00	3.42	93.43	75.75	0.08	1.15
		B2	0.00	95.17	4.74	0.09	3.35	98.07	76.67	-0.30	1.17
		B3	0.00	53.36	44.29	2.35	4.10	58.31	57.81	0.16	1.19
		B4	0.00	90.43	9.37	0.19	3.16	111.88	68.01	0.37	1.28
		B5	0.00	83.33	16.67	0.00	3.46	90.87	66.35	-0.28	1.81
		B6	0.06	92.98	7.18	0.00	2.53	173.14	53.66	-0.47	0.71
		B7	0.00	77.23	21.61	1.15	3.11	115.82	48.70	0.44	1.34
		B8	0.00	79.22	18.77	2.01	3.17	111.11	48.15	0.38	1.25
		B9	0.00	70.35	29.12	0.53	3.50	88.39	52.65	-0.14	1.37
1991	Summer	B1	0.00	92.80	6.63	0.58	3.33	N.A.	79.35	0.32	1.26
		B2	2.29	95.26	2.43	0.02	2.22	N.A.	72.63	-0.38	3.06
		B3	0.00	63.27	36.73	0.00	3.78	N.A.	72.64	0.30	0.75
		B4	0.00	88.97	11.03	0.00	2.98	N.A.	73.03	0.38	1.16
		B5	0.00	90.78	9.22	0.00	3.04	N.A.	68.26	-0.41	1.92
		B6	0.00	91.86	7.84	0.29	3.22	N.A.	73.66	-0.20	2.16
		B7	0.00	72.44	23.86	3.69	3.39	N.A.	45.63	0.44	1.16
		B8	0.00	77.05	22.95	0.00	3.13	N.A.	55.40	-0.03	0.82
		B9	0.00	75.16	24.05	0.80	3.45	N.A.	53.72	-0.01	1.54
1990	Summer	B1	0.00	74.79	20.71	4.51	3.85	N.A.	60.38	0.54	1.57
		B2	0.00	88.10	10.99	0.91	3.52	N.A.	74.87	0.50	3.17
		B3	0.00	60.17	38.43	1.40	3.92	N.A.	67.80	0.45	0.96
		B4	0.00	85.98	13.13	0.89	3.22	N.A.	66.20	0.47	1.81
		B5	0.00	85.76	14.07	0.17	3.29	N.A.	66.67	-0.07	2.24
		B6	0.00	90.70	8.60	0.71	3.46	N.A.	78.61	0.13	1.89
		B7	0.00	72.91	21.74	5.35	3.28	N.A.	42.63	0.51	1.28
		B8	0.00	73.71	24.06	2.23	2.65	N.A.	47.26	0.35	1.29
		B9	0.00	73.41	24.86	1.73	3.45	N.A.	52.57	0.04	1.24
1988	Winter	B1	0.00	90.12	8.51	1.37	3.06	N.A.	66.99	0.32	1.33
		B2	0.00	95.08	4.25	0.67	3.19	N.A.	71.97	0.06	1.31
		B3	0.00	47.52	49.16	3.32	4.16	N.A.	61.65	0.11	1.27
		B4	0.00	74.46	23.81	1.73	3.66	N.A.	71.16	0.45	0.77
		B5	0.00	84.56	14.10	1.34	3.35	N.A.	62.71	-0.13	2.12
		B6	-	-	-	-	-	-	-	-	
		B7	-	-	-	-	-	-	-	-	
		B8	-	-	-	-	-	-	-	-	
		B9	-	-	-	-	-	-	-	-	
1988	Summer	B1	0.00	86.92	13.08	0.00	3.17	N.A.	66.43	0.26	1.15
		B2	0.00	90.49	8.68	0.83	3.29	N.A.	76.97	0.19	1.72
		B3	0.00	63.50	35.02	1.48	3.82	N.A.	67.59	0.35	0.89
		B4	0.00	74.92	25.08	0.00	3.60	N.A.	68.78	0.35	0.98
		B5	0.00	80.35	19.65	0.00	3.48	N.A.	71.23	0.15	1.38
		B6	-	-	-	-	-	-	-	-	
		B7	-	-	-	-	-	-	-	-	
		B8	-	-	-	-	-	-	-	-	
		B9	-	-	-	-	-	-	-	-	
1986	Winter	B1	0.00	79.81	18.89	1.31	3.62	N.A.	69.87	0.45	1.39
		B2	0.00	96.95	2.56	0.49	3.24	N.A.	79.39	0.16	1.37
		B3	0.00	62.60	35.96	1.37	3.79	N.A.	65.94	0.43	0.82
		B4	0.00	69.04	25.96	5.00	3.97	N.A.	59.15	0.53	2.00
		B5	0.00	81.08	16.07	2.85	3.69	N.A.	71.30	0.49	1.57
		B6	-	-	-	-	-	-	-	-	
		B7	-	-	-	-	-	-	-	-	
		B8	-	-	-	-	-	-	-	-	
		B9	-	-	-	-	-	-	-	-	
1986	Summer	B1	0.00	82.04	14.74	3.21	3.87	N.A.	71.98	0.56	2.48
		B2	0.00	92.53	6.15	1.32	3.57	N.A.	82.37	0.20	0.96
		B3	0.00	55.10	40.76	4.15	4.32	N.A.	59.95	0.40	1.91
		B4	0.00	82.95	16.72	0.33	3.39	N.A.	64.81	0.16	0.90
		B5	0.00	86.11	13.67	0.22	3.69	N.A.	80.62	0.15	0.98
		B6	-	-	-	-	-	-	-	-	
		B7	-	-	-	-	-	-	-	-	
		B8	-	-	-	-	-	-	-	-	
		B9	-	-	-	-	-	-	-	-	

Appendix D-1. (Cont.).

Year	Season	Station	Mean grain size								
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	phi	μm	Sorting	Skewness	Kurtosis
1980	Winter	B1	0.00	80.80	18.50	0.67	3.58	N.A.	0.54	0.57	0.76
		B2	0.00	51.70	46.20	2.06	3.99	N.A.	0.76	0.08	0.72
		B3	0.00	39.60	50.30	9.58	4.70	N.A.	1.61	0.19	1.69
		B4	0.00	65.50	32.20	2.31	3.80	N.A.	0.86	0.40	1.05
		B5	0.00	52.10	43.50	4.34	4.09	N.A.	0.82	0.20	1.77
		B6	0.00	58.00	37.40	4.63	3.78	N.A.	1.21	0.10	1.20
		B7	0.00	90.90	7.40	1.73	3.35	N.A.	0.31	0.38	1.99
		B8	0.00	79.20	19.10	1.74	3.65	N.A.	0.58	0.55	0.48
		B9	0.00	73.90	23.60	2.52	3.75	N.A.	0.70	0.58	0.99
1980	Summer	B1	0.00	78.40	21.40	0.00	3.67	N.A.	0.49	0.20	0.83
		B2	0.00	40.60	52.10	7.04	4.35	N.A.	0.95	0.12	2.65
		B3	0.00	49.30	43.70	6.78	4.14	N.A.	1.17	0.10	2.50
		B4	0.00	44.40	50.50	4.98	4.13	N.A.	0.70	0.06	2.43
		B5	0.00	42.40	50.70	6.69	4.21	N.A.	0.72	0.09	3.83
		B6	0.00	45.00	48.60	6.19	4.27	N.A.	0.94	0.17	3.23
		B7	0.00	93.50	4.15	2.33	3.54	N.A.	0.28	0.14	2.64
		B8	0.00	63.20	34.30	2.57	3.94	N.A.	0.61	0.33	1.33
		B9	0.00	65.50	32.20	2.30	3.96	N.A.	0.69	0.36	1.97
1978	Winter	B1	0.50	68.45	31.55	1.52	3.75	N.A.	0.65	0.22	N.A.
		B2	0.00	38.70	61.30	0.52	4.12	N.A.	0.57	0.13	N.A.
		B3	0.00	12.14	87.86	11.10	5.31	N.A.	1.80	0.45	N.A.
		B4	0.00	38.72	61.28	5.90	4.32	N.A.	0.92	0.20	N.A.
		B5	0.00	52.11	47.89	3.50	3.95	N.A.	0.86	0.17	N.A.
		B6	0.00	41.08	58.92	3.90	4.15	N.A.	0.83	0.14	N.A.
		B7	0.00	88.52	11.48	1.02	3.62	N.A.	0.36	-0.11	N.A.
		B8	0.00	69.91	30.09	4.35	3.83	N.A.	0.87	0.38	N.A.
		B9	0.00	67.51	32.49	2.75	3.77	N.A.	0.99	0.06	N.A.
1978	Summer	B1	0.50	65.99	33.96	1.60	3.82	N.A.	0.70	0.22	N.A.
		B2	0.00	43.52	56.48	0.10	4.05	N.A.	0.54	0.02	N.A.
		B3	0.00	15.22	84.78	8.20	4.86	N.A.	1.40	0.42	N.A.
		B4	0.00	33.37	66.63	0.35	4.26	N.A.	0.76	0.28	N.A.
		B5	0.00	44.84	55.16	1.20	4.14	N.A.	0.84	0.28	N.A.
		B6	0.00	49.09	50.91	2.90	3.86	N.A.	1.52	-0.12	N.A.
		B7	0.00	76.39	23.61	0.95	3.74	N.A.	0.60	0.26	N.A.
		B8	0.00	53.76	46.24	2.50	4.09	N.A.	0.90	0.42	N.A.
		B9	0.00	34.64	65.36	3.70	4.36	N.A.	1.04	0.25	N.A.

N.A. = Not Available

- = Not Sampled

Appendix E. Sediment chemistry by station. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.



MBC Applied Env. Sciences
3000 Redhill Avenue
Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: 01306A/01213A HAGS NPDES

Report Number: IKG0034

Sampled: 06/25/01
Received: 07/03/01

METALS

Analyte	Method	Batch	Reporting	Sample	Dilution	Date	Date	Data
			Limit			Extracted	Analyzed	Qualifiers
			mg/kg dry	mg/kg dry				
Sample ID: IKG0034-01 (B1 - Solid)								
Chromium	EPA 6010B	IIG0543	1.6	11	1	7/5/01	7/5/01	
Copper	EPA 6010B	IIG0543	1.6	12	1	7/5/01	7/5/01	
Nickel	EPA 6010B	IIG0543	1.6	9.6	1	7/5/01	7/5/01	
Zinc	EPA 6010B	IIG0543	7.8	51	1	7/5/01	7/5/01	
Sample ID: IKG0034-02 (B2 - Solid)								
Chromium	EPA 6010B	IIG0543	1.5	8.8	1	7/5/01	7/5/01	
Copper	EPA 6010B	IIG0543	1.5	6.3	1	7/5/01	7/5/01	
Nickel	EPA 6010B	IIG0543	1.5	6.2	1	7/5/01	7/5/01	
Zinc	EPA 6010B	IIG0543	7.4	31	1	7/5/01	7/5/01	
Sample ID: IKG0034-03 (B3 - Solid)								
Chromium	EPA 6010B	IIG0543	1.4	13	1	7/5/01	7/5/01	
Copper	EPA 6010B	IIG0543	1.4	8.5	1	7/5/01	7/5/01	
Nickel	EPA 6010B	IIG0543	1.4	8.8	1	7/5/01	7/5/01	
Zinc	EPA 6010B	IIG0543	7.0	40	1	7/5/01	7/5/01	
Sample ID: IKG0034-04 (B4 - Solid)								
Chromium	EPA 6010B	IIG0543	1.7	18	1	7/5/01	7/5/01	
Copper	EPA 6010B	IIG0543	1.7	19	1	7/5/01	7/5/01	
Nickel	EPA 6010B	IIG0543	1.7	13	1	7/5/01	7/5/01	
Zinc	EPA 6010B	IIG0543	8.3	72	1	7/5/01	7/5/01	

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Michele Harper
Project Manager Supervisor

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 9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-085

MBC Applied Env. Sciences
 3000 Redhill Avenue
 Costa Mesa, CA 92626-4524
 Attention: Mike Curtis

Project ID: 01306A/01213A HAGS NPDES

Report Number: IKG0034

Sampled: 06/25/01

Received: 07/03/01

METALS

Analyte	Method	Batch	Reporting	Sample	Dilution	Date	Date	Data
			Limit			Extracted	Analyzed	Qualifier:
			mg/kg dry	mg/kg dry				
Sample ID: IKG0034-05 (B5 - Solid)								
Chromium	EPA 6010B	IIG0543	1.6	12	1	7/5/01	7/5/01	
Copper	EPA 6010B	IIG0543	1.6	8.7	1	7/5/01	7/5/01	
Nickel	EPA 6010B	IIG0543	1.6	8.4	1	7/5/01	7/5/01	
Zinc	EPA 6010B	IIG0543	7.8	40	1	7/5/01	7/5/01	
Sample ID: IKG0034-06 (B6 - Solid)								
Chromium	EPA 6010B	IIG0543	1.5	12	1	7/5/01	7/5/01	
Copper	EPA 6010B	IIG0543	1.5	8.7	1	7/5/01	7/5/01	
Nickel	EPA 6010B	IIG0543	1.5	9.2	1	7/5/01	7/5/01	
Zinc	EPA 6010B	IIG0543	7.4	42	1	7/5/01	7/5/01	
Sample ID: IKG0034-07 (B7 - Solid)								
Chromium	EPA 6010B	IIG0543	1.8	29	1	7/5/01	7/5/01	
Copper	EPA 6010B	IIG0543	1.8	24	1	7/5/01	7/5/01	
Nickel	EPA 6010B	IIG0543	1.8	16	1	7/5/01	7/5/01	
Zinc	EPA 6010B	IIG0543	9.1	82	1	7/5/01	7/5/01	
Sample ID: IKG0034-08 (B8 - Solid)								
Chromium	EPA 6010B	IIG0543	1.4	13	1	7/5/01	7/5/01	
Copper	EPA 6010B	IIG0543	1.4	6.1	1	7/5/01	7/5/01	
Nickel	EPA 6010B	IIG0543	1.4	7.1	1	7/5/01	7/5/01	
Zinc	EPA 6010B	IIG0543	7.2	34	1	7/5/01	7/5/01	

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 Project Manager Supervisor

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Appendix E. (Cont.).



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 9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851

MBC Applied Env. Sciences
 3000 Redhill Avenue
 Costa Mesa, CA 92626-4524
 Attention: Mike Curtis

Project ID: 01306A/01213A HAGS NPDES

Sampled: 06/25/01
 Received: 07/03/01

Report Number: IKG0034

METALS

Analyte	Method	Batch	Reporting	Sample	Dilution	Date	Date	Data
			Limit			Extracted	Analyzed	Qualifiers
			mg/kg dry	mg/kg dry				
Sample ID: IKG0034-09 (B9 - Solid)								
Chromium	EPA 6010B	I1G0543	1.3	13	1	7/5/01	7/5/01	
Copper	EPA 6010B	I1G0543	1.3	7.6	1	7/5/01	7/5/01	
Nickel	EPA 6010B	I1G0543	1.3	7.8	1	7/5/01	7/5/01	
Zinc	EPA 6010B	I1G0543	6.6	35	1	7/5/01	7/5/01	
Sample ID: IKG0034-10 (B10 - Solid)								
Chromium	EPA 6010B	I1G0543	1.7	8.4	1	7/5/01	7/5/01	
Copper	EPA 6010B	I1G0543	1.7	18	1	7/5/01	7/5/01	
Nickel	EPA 6010B	I1G0543	1.7	7.8	1	7/5/01	7/5/01	
Zinc	EPA 6010B	I1G0543	8.5	79	1	7/5/01	7/5/01	
Sample ID: IKG0034-11 (B11 - Solid)								
Chromium	EPA 6010B	I1G0543	1.4	11	1	7/5/01	7/5/01	
Copper	EPA 6010B	I1G0543	1.4	25	1	7/5/01	7/5/01	
Nickel	EPA 6010B	I1G0543	1.4	8.4	1	7/5/01	7/5/01	
Zinc	EPA 6010B	I1G0543	6.9	52	1	7/5/01	7/5/01	
Sample ID: IKG0034-12 (B12 - Solid)								
Chromium	EPA 6010B	I1G0543	1.3	7.1	1	7/5/01	7/5/01	
Copper	EPA 6010B	I1G0543	1.3	15	1	7/5/01	7/5/01	
Nickel	EPA 6010B	I1G0543	1.3	5.9	1	7/5/01	7/5/01	
Zinc	EPA 6010B	I1G0543	6.5	36	1	7/5/01	7/5/01	

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 Michele Harper
 Project Manager Supervisor

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 9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851

MBC Applied Env. Sciences
 3000 Redhill Avenue
 Costa Mesa, CA 92626-4524
 Attention: Mike Curtis

Project ID: 01306A/01213A HAGS NPDES

Report Number: IKG0034

Sampled: 06/25/01
 Received: 07/03/01

INORGANICS

Analyte	Method	Batch	Reporting	Sample	Dilution	Date	Date	Data
			Limit			Factor	Extracted	
			%	%				
Sample ID: IKG0034-01 (B1 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	64	1	7/3/01		7/3/01	
Sample ID: IKG0034-02 (B2 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	68	1	7/3/01		7/3/01	
Sample ID: IKG0034-03 (B3 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	72	1	7/3/01		7/3/01	
Sample ID: IKG0034-04 (B4 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	60	1	7/3/01		7/3/01	
Sample ID: IKG0034-05 (B5 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	64	1	7/3/01		7/3/01	
Sample ID: IKG0034-06 (B6 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	68	1	7/3/01		7/3/01	
Sample ID: IKG0034-07 (B7 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	55	1	7/3/01		7/3/01	
Sample ID: IKG0034-08 (B8 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	70	1	7/3/01		7/3/01	

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 9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851

MBC Applied Env. Sciences
 3000 Redhill Avenue
 Costa Mesa, CA 92626-4524
 Attention: Mike Curtis

Project ID: 01306A/01213A HAGS NPDES

Report Number: IKG0034

Sampled: 06/25/01

Received: 07/03/01

INORGANICS

Analyte	Method	Reporting Limit		Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
		Batch	%					
Sample ID: IKG0034-09 (B9 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	76	1	7/3/01	7/3/01		
Sample ID: IKG0034-10 (B10 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	59	1	7/3/01	7/3/01		
Sample ID: IKG0034-11 (B11 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	73	1	7/3/01	7/3/01		
Sample ID: IKG0034-12 (B12 - Solid)								
Percent Solids	EPA 160.3 MODIIG0351	0.010	77	1	7/3/01	7/3/01		

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 Project Manager Supervisor

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MBC Applied Env. Sciences
3000 Redhill Avenue
Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: 01306A/01213A HAGS NPDES

Report Number: IKG0034

2852 Alton Ave., Irvine, CA 92606 (949) 261-1022 FAX (949) 261-1200
1014 E. Colby Dr., Suite A, Colton, CA 92324 (909) 370-4667 FAX (909) 370-1020
7277 Hayvenhurst, Suite B-12, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779-1848
9484 Chesapeake Dr., Suite 805, San Diego, CA 92123 (858) 505-8596 FAX (858) 505-9581
9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0881

Sampled: 06/25/01

Received: 07/03/01

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifier
<u>Batch: IIG0543 Extracted: 07/05/01</u>										
Blank Analyzed: 07/06/01 (IIG0543-BLK1)										
Chromium ND 1.0 mg/kg wet										
Copper ND 1.0 mg/kg wet										
Nickel ND 1.0 mg/kg wet										
Zinc ND 5.0 mg/kg wet										
LCS Analyzed: 07/06/01 (IIG0543-BS1)										
Chromium	49.7	1.0	mg/kg wet	50.0		99.4	80-120			
Copper	49.7	1.0	mg/kg wet	50.0		99.4	80-120			
Nickel	49.2	1.0	mg/kg wet	50.0		98.4	80-120			
Zinc	49.0	5.0	mg/kg wet	50.0		98.0	80-120			
Matrix Spike Analyzed: 07/06/01 (IIG0543-MS1)										
Source: IKG0044-01										
Chromium	75.3	1.0	mg/kg wet	50.0	26	98.6	75-125			
Copper	85.6	1.0	mg/kg wet	50.0	42	87.2	75-125			
Nickel	67.7	1.0	mg/kg wet	50.0	21	93.4	75-125			
Zinc	138	5.0	mg/kg wet	50.0	97	82.0	75-125			
Matrix Spike Dup Analyzed: 07/06/01 (IIG0543-MSD1)										
Source: IKG0044-01										
Chromium	70.6	1.0	mg/kg wet	50.0	26	89.2	75-125	6.44	20	
Copper	81.2	1.0	mg/kg wet	50.0	42	78.4	75-125	5.28	20	
Nickel	64.0	1.0	mg/kg wet	50.0	21	86.0	75-125	5.62	20	
Zinc	144	5.0	mg/kg wet	50.0	97	94.0	75-125	4.26	20	

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Michele Harper
Project Manager Supervisor

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MBC Applied Env. Sciences
3000 Redhill Avenue
Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: 01306A/01213A HAGS NPDES

Report Number: IKG0034

Sampled: 06/25/01
Received: 07/03/01

METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC Limits	RPD RPD	RPD Limit	Data Qualifiers
<u>Batch: I1G0351 Extracted: 07/03/01</u>									
Blank Analyzed: 07/03/01 (I1G0351-BLK1)									
Percent Solids	ND	0.010	%						
Duplicate Analyzed: 07/03/01 (I1G0351-DUP1)									
Percent Solids	63.0	0.010	%		64		1.57	20	Source: IKG0034-01

Del Mar Analytical, Irvine
Michele Harper
Project Manager Supervisor

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Appendix E. (Cont.).



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MBC Applied Env. Sciences
3000 Redhill Avenue
Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: 01306A/01213A HAGS NPDES

Report Number: IKG0034

Sampled: 06/25/01
Received: 07/03/01

DATA QUALIFIERS AND DEFINITIONS

- ND** Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.
NR Not reported.
RPD Relative Percent Difference

Del Mar Analytical, Irvine
Michele Harper
Project Manager Supervisor

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Appendix E-1. Yearly sediment metal concentrations (mg/dry kg), 1990 - 2001. Haynes and AES Alamitos L.L.C. generating station NPDES, 2001.

Metal	Station	YEAR										Mean
		1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	
Chromium ERL = 81	B1	8.6	9.3	11.0	9.9	8.4	12.0	9.8	8.9	12.0	11	10.1
	B2	9.7	14.0	12.0	9.8	7.4	9.5	6.0	8.4	10.0	8.8	9.6
	B3	13.5	11.0	21.0	9.1	13.0	14.0	9.0	11.0	12.0	13	12.7
	B4	17.2	9.2	12.0	9.9	10.0	12.0	7.0	12.0	11.0	18	11.8
	B5	8.9	8.3	12.0	9.4	11.0	2.9	-	11.0	12.0	12	9.7
	B6	8.0	9.3	13.0	10.0	9.7	13.0	-	9.2	16.0	12	11.1
	B7	17.2	17.0	22.0	33.0	21.0	28.0	-	34.0	22.0	29	24.8
	B8	17.2	12.0	26.0	11.0	15.0	11.0	-	11.0	13.0	13	14.4
	B9	10.0	13.0	18.0	18.0	15.0	12.0	-	ND	18.0	13	13.0
	B10	-	-	-	-	-	-	-	-	-	8.4	8.4
	B11	-	-	-	-	-	-	-	-	-	11	11
	B12	-	-	-	-	-	-	-	-	-	7.1	7.1
Copper ERL = 34	B1	7.7	12.0	11.0	14.0	9.9	8.0	16.0	9.6	12.0	12	11.2
	B2	4.5	9.1	6.8	7.1	4.4	3.5	4.3	4.7	4.8	6.3	5.6
	B3	8.0	8.3	15.0	6.5	9.0	8.3	6.8	7.7	6.3	8.5	8.4
	B4	10.0	10.0	12.0	11.0	10.0	7.9	8.4	11.0	10.0	19	10.9
	B5	4.6	5.7	7.1	6.9	5.8	1.2	-	6.9	5.4	8.7	5.8
	B6	5.0	7.0	7.3	7.4	7.1	6.4	-	5.4	7.9	8.7	6.9
	B7	9.4	14.0	14.0	39.0	18.0	14.0	-	30.0	15.0	24	19.7
	B8	7.7	7.7	21.0	9.2	9.7	4.9	-	4.9	5.9	6.1	8.6
	B9	6.3	9.0	11.0	19.0	13.0	6.3	-	ND	7.1	7.6	8.8
	B10	-	-	-	-	-	-	-	-	-	18	18
	B11	-	-	-	-	-	-	-	-	-	25	25
	B12	-	-	-	-	-	-	-	-	-	15	15
Nickel ERL = 21	B1	9.8	7.2	7.9	9.4	6.2	7.1	11.0	5.8	9.2	9.6	8.3
	B2	9.1	9.1	6.7	6.7	4.0	4.8	4.0	4.4	6.2	6.2	6.1
	B3	13.3	7.0	13.0	6.3	7.4	7.6	6.7	6.5	8.1	8.8	8.5
	B4	10.2	6.9	8.2	8.8	7.4	7.8	6.3	8.3	8.8	13	8.6
	B5	6.6	4.7	7.1	6.4	5.5	1.3	-	6.0	7.1	8.4	5.9
	B6	8.4	6.6	7.3	7.4	6.0	8.1	-	5.3	10.0	9.2	7.6
	B7	10.6	9.4	11.0	23.0	10.0	9.7	-	17.0	12.0	16	13.2
	B8	11.7	6.5	15.0	7.7	7.5	6.2	-	4.8	7.3	7.1	8.2
	B9	10.0	6.8	9.8	15.0	8.8	7.2	-	ND	8.5	7.8	8.2
	B10	-	-	-	-	-	-	-	-	-	7.8	7.8
	B11	-	-	-	-	-	-	-	-	-	8.4	8.4
	B12	-	-	-	-	-	-	-	-	-	5.9	5.9
Zinc ERL = 150	B1	33	40	41	50	32	43	60	39	47	51	43.6
	B2	26	39	29	33	19	25	29	25	30	31	28.6
	B3	40	34	62	33	35	46	41	36	36	40	40.3
	B4	42	39	44	47	38	45	45	51	46	72	46.9
	B5	25	22	29	33	25	8	-	33	32	40	27.4
	B6	29	31	32	37	29	41	-	29	42	42	34.7
	B7	42	46	52	120	51	58	-	86	58	82	66.1
	B8	39	32	28	41	37	32	-	28	33	34	33.8
	B9	32	32	41	75	40	35	-	ND	39	35	36.6
	B10	-	-	-	-	-	-	-	-	-	79	79
	B11	-	-	-	-	-	-	-	-	-	52	52
	B12	-	-	-	-	-	-	-	-	-	36	36
Fines	B1	25.2	7.2	8.0	45.2	37.3	19.1	13.4	16.3	3.3	15.4	19.0
	B2	11.9	2.5	4.8	7.3	2.7	5.4	3.6	8.1	3.2	9.0	5.8
	B3	39.8	36.7	46.6	37.1	39.0	30.6	38.4	26.6	3.6	13.1	31.1
	B4	14.0	11.0	9.6	27.4	29.2	27.8	15.6	20.8	3.4	13.2	17.2
	B5	14.2	9.2	16.7	19.7	16.5	0.8	-	19.9	3.5	22.4	13.7
	B6	9.3	8.1	7.2	15.1	14.6	15.9	-	9.7	2.5	11.4	10.4
	B7	27.1	27.6	22.8	65.9	42.7	30.7	-	66.9	5.0	50.2	37.7
	B8	26.3	23.0	20.8	41.4	55.7	10.3	-	8.1	2.5	12.3	22.3
	B9	26.6	24.9	29.7	56.8	27.1	31.5	-	26.9	3.3	28.6	28.4
	B10	-	-	-	-	-	-	-	-	-	28.3	28.3
	B11	-	-	-	-	-	-	-	-	-	22.9	22.9
	B12	-	-	-	-	-	-	-	-	-	8.5	8.5

- = not sampled

ND = below the detection limit (for calculations ND = 0)

Appendix F. Mussel chemistry by station. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.



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Attention: Mike Curtis

Project ID: HAGS NPDES 01306A/01213A

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2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

Report Number: IKJ1096

Sampled: 10/15/01-10/16/01
Received: 10/26/01

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
mg/kg dry mg/kg dry								
Sample ID: IKJ1096-01 (MT-I - Solid)				Sampled: 10/15/01				
Chromium	EPA 6010B	IIJ3046	7.5	ND	1	10/30/01	10/31/01	
Copper	EPA 6010B	IIJ3046	7.5	12	1	10/30/01	10/31/01	
Nickel	EPA 6010B	IIJ3046	7.5	ND	1	10/30/01	10/31/01	
Zinc	EPA 6010B	IIJ3046	38	190	1	10/30/01	10/31/01	
Sample ID: IKJ1096-02 (MT-II - Solid)				Sampled: 10/15/01				
Chromium	EPA 6010B	IIJ3046	5.9	ND	1	10/30/01	10/31/01	
Copper	EPA 6010B	IIJ3046	5.9	7.7	1	10/30/01	10/31/01	
Nickel	EPA 6010B	IIJ3046	5.9	ND	1	10/30/01	10/31/01	
Zinc	EPA 6010B	IIJ3046	30	110	1	10/30/01	10/31/01	
Sample ID: IKJ1096-03 (MT-III - Solid)				Sampled: 10/15/01				
Chromium	EPA 6010B	IIJ3046	7.7	ND	1	10/30/01	10/31/01	
Copper	EPA 6010B	IIJ3046	7.7	12	1	10/30/01	10/31/01	
Nickel	EPA 6010B	IIJ3046	7.7	ND	1	10/30/01	10/31/01	
Zinc	EPA 6010B	IIJ3046	39	210	1	10/30/01	10/31/01	
Sample ID: IKJ1096-04 (MT-Cl - Solid)				Sampled: 10/16/01				
Chromium	EPA 6010B	IIJ3046	8.7	ND	1	10/30/01	10/31/01	
Copper	EPA 6010B	IIJ3046	8.7	11	1	10/30/01	10/31/01	
Nickel	EPA 6010B	IIJ3046	8.7	ND	1	10/30/01	10/31/01	
Zinc	EPA 6010B	IIJ3046	43	150	1	10/30/01	10/31/01	

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Xuan Huong Dang
Project Manager

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MBC Applied Env. Sciences
 3000 Redhill Avenue
 Costa Mesa, CA 92626-4524
 Attention: Mike Curtis

Project ID: HAGS NPDES 01306A/01213A

Report Number: IKJ1096

Sampled: 10/15/01-10/16/01

Received: 10/26/01

INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Date Qualifier
			%	%				
Sample ID: IKJ1096-01 (MT-I - Solid)				Sampled: 10/15/01				
Percent Solids	EPA 160.3 MOD I1J2975	0.010	13	1	1	10/29/01	10/29/01	
Sample ID: IKJ1096-02 (MT-II - Solid)				Sampled: 10/15/01				
Percent Solids	EPA 160.3 MOD I1J2975	0.010	17	1	1	10/29/01	10/29/01	
Sample ID: IKJ1096-03 (MT-III - Solid)				Sampled: 10/15/01				
Percent Solids	EPA 160.3 MOD I1J2975	0.010	13	1	1	10/29/01	10/29/01	
Sample ID: IKJ1096-04 (MT-Cl - Solid)				Sampled: 10/16/01				
Percent Solids	EPA 160.3 MOD I1J2975	0.010	12	1	1	10/29/01	10/29/01	

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 Attention: Mike Curtis

Project ID: HAGS NPDES 01306A/01213A

Report Number: IKJ1096

Sampled: 10/15/01-10/16/01
 Received: 10/26/01

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC %REC	%REC Limits	RPD RPD	RPD Limit	Data Qualifiers
Batch: I1J3046 Extracted: 10/30/01										
Blank Analyzed: 10/31/01 (I1J3046-BLK1)										
Chromium ND 1.0 mg/kg wet										
Copper ND 1.0 mg/kg wet										
Nickel ND 1.0 mg/kg wet										
Zinc ND 5.0 mg/kg wet										
LCS Analyzed: 10/31/01 (I1J3046-BS1)										
Chromium	48.9	1.0	mg/kg wet	50.0		97.8	80-120			
Copper	47.8	1.0	mg/kg wet	50.0		95.6	80-120			
Nickel	48.8	1.0	mg/kg wet	50.0		97.6	80-120			
Zinc	48.3	5.0	mg/kg wet	50.0		96.6	80-120			
Matrix Spike Analyzed: 10/31/01 (I1J3046-MS1)										
Chromium 139 1.0 mg/kg wet 50.0 88 102 75-125										
Copper 148 1.0 mg/kg wet 50.0 91 114 75-125										
Nickel 74.6 1.0 mg/kg wet 50.0 26 97.2 75-125										
Zinc 387 5.0 mg/kg wet 50.0 330 114 75-125										
Matrix Spike Dup Analyzed: 10/31/01 (I1J3046-MSD1)										
Chromium 136 1.0 mg/kg wet 50.0 88 96.0 75-125 2.18 20										
Copper 144 1.0 mg/kg wet 50.0 91 106 75-125 2.74 20										
Nickel 74.0 1.0 mg/kg wet 50.0 26 96.0 75-125 0.808 20										
Zinc 370 5.0 mg/kg wet 50.0 330 80.0 75-125 4.49 20										

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MBC Applied Env. Sciences
3000 Redhill Avenue
Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: HAGS NPDES 01306A/01213A

Report Number: IKJ1096

Sampled: 10/15/01-10/16/01
Received: 10/26/01

METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC %REC	%REC Limits	RPD RPD	RPD Limit	Data Qualifiers
Batch: I1J2975_Extracted: 10/29/01										
Blank Analyzed: 10/29/01 (I1J2975-BLK1)										
Percent Solids	ND	0.010	%							
Duplicate Analyzed: 10/29/01 (I1J2975-DUP1)										
Percent Solids	12.4	0.010	%		Source: IKJ0978-01	12		3.28	20	

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Project ID: HAGS NPDES 01306A/01213A

Report Number: IKJ1096

Sampled: 10/15/01-10/16/01

Received: 10/26/01

DATA QUALIFIERS AND DEFINITIONS

- ND** Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.
NR Not reported.
RPD Relative Percent Difference

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Xuan Huong Dang
Project Manager

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Project ID: 01204A Catalina NPDES

Report Number: IKJ1098

Sampled: 10/19/01

Received: 10/26/01

METALS

Analyte	Method	Batch	Reporting	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifier
			Limit			mg/kg dry	mg/kg dry	
Sample ID: IKJ1098-04 (MT-MNC I - Solid)								
Chromium	EPA 6010B	I1J3081	7.9	ND	1	10/30/01	10/31/01	
Copper	EPA 6010B	I1J3081	7.9	13	1	10/30/01	10/31/01	
Nickel	EPA 6010B	I1J3081	7.9	ND	1	10/30/01	10/31/01	
Zinc	EPA 6010B	I1J3081	40	270	1	10/30/01	10/31/01	
Sample ID: IKJ1098-05 (MT-MNC II - Solid)								
Chromium	EPA 6010B	I1J3140	7.4	ND	1	10/31/01	11/2/01	
Copper	EPA 6010B	I1J3140	7.4	16	1	10/31/01	11/2/01	
Nickel	EPA 6010B	I1J3140	7.4	ND	1	10/31/01	11/2/01	
Zinc	EPA 6010B	I1J3140	37	170	1	10/31/01	11/2/01	
Sample ID: IKJ1098-06 (MT-MNC III - Solid)								
Chromium	EPA 6010B	I1J3140	9.5	ND	1	10/31/01	11/2/01	
Copper	EPA 6010B	I1J3140	9.5	16	1	10/31/01	11/2/01	
Nickel	EPA 6010B	I1J3140	9.5	ND	1	10/31/01	11/2/01	
Zinc	EPA 6010B	I1J3140	47	250	1	10/31/01	11/2/01	

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3000 Redhill Avenue
Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: 01204A Catalina NPDES

Report Number: IKJ1098

Sampled: 10/19/01

Received: 10/26/01

INORGANICS

Analyte	Method	Batch	Reporting	Sample	Dilution	Date	Date	Data
			Limit			Factor	Extracted	Analyzed
			%	%				
Sample ID: IKJ1098-04 (MT-MNC I - Solid)								
Percent Solids	EPA 160.3 MOD IIJ2975		0.010	13	1	10/29/01	10/29/01	
Sample ID: IKJ1098-05 (MT-MNC II - Solid)								
Percent Solids	EPA 160.3 MOD IIJ2975		0.010	14	1	10/29/01	10/29/01	
Sample ID: IKJ1098-06 (MT-MNC III - Solid)								
Percent Solids	EPA 160.3 MOD IIJ2975		0.010	11	1	10/29/01	10/29/01	

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Appendix F. (Cont.).



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Project ID: 01204A Catalina NPDES

Report Number: IKJ1098

Sampled: 10/19/01

Received: 10/26/01

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD RPD	RPD Limit	Data Qualifier:
Batch: I1J3081 Extracted: 10/30/01										
Blank Analyzed: 11/01/01 (I1J3081-BLK1)										
Chromium ND 1.0 mg/kg wet										
Copper ND 1.0 mg/kg wet										
Nickel ND 1.0 mg/kg wet										
Zinc ND 5.0 mg/kg wet										
LCS Analyzed: 10/31/01 (I1J3081-BS1)										
Chromium	49.8	1.0	mg/kg wet	50.0		100	80-120			
Copper	46.3	1.0	mg/kg wet	50.0		93	80-120			
Nickel	48.2	1.0	mg/kg wet	50.0		96	80-120			
Zinc	48.2	5.0	mg/kg wet	50.0		96	80-120			
Matrix Spike Analyzed: 10/31/01 (I1J3081-MS1)										
Source: IKJ1142-21										
Chromium	55.3	1.0	mg/kg wet	50.0	9.1	92	75-125			
Copper	51.4	1.0	mg/kg wet	50.0	4.1	95	75-125			
Nickel	54.1	1.0	mg/kg wet	50.0	7.0	94	75-125			
Zinc	64.4	5.0	mg/kg wet	50.0	17	95	75-125			
Matrix Spike Dup Analyzed: 10/31/01 (I1J3081-MSD1)										
Source: IKJ1142-21										
Chromium	55.2	1.0	mg/kg wet	50.0	9.1	92	75-125	0	20	
Copper	50.6	1.0	mg/kg wet	50.0	4.1	93	75-125	2	20	
Nickel	52.7	1.0	mg/kg wet	50.0	7.0	91	75-125	3	20	
Zinc	63.5	5.0	mg/kg wet	50.0	17	93	75-125	1	20	

Batch: I1J3140 Extracted: 10/31/01

Blank Analyzed: 11/02/01 (I1J3140-BLK1)

Chromium	ND	1.0	mg/kg wet
Copper	ND	1.0	mg/kg wet
Nickel	ND	1.0	mg/kg wet
Zinc	ND	5.0	mg/kg wet

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Appendix F. (Cont.).



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Report Number: IKJ1098

Sampled: 10/19/01

Received: 10/26/01

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9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851
2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC %REC Limits	RPD RPD	RPD Limit	Data Qualifiers
<u>Batch: I1J3140 Extracted: 10/31/01</u>									
LCS Analyzed: 11/02/01 (I1J3140-BS1)									
Chromium	51.8	1.0	mg/kg wet	50.0		104	80-120		
Copper	49.5	1.0	mg/kg wet	50.0		99	80-120		
Nickel	49.8	1.0	mg/kg wet	50.0		100	80-120		
Zinc	49.3	5.0	mg/kg wet	50.0		99	80-120		
Matrix Spike Analyzed: 11/03/01 (I1J3140-MS1)									
Chromium	56.3	1.0	mg/kg wet	50.0	18	77	75-125		
Copper	60.0	1.0	mg/kg wet	50.0	21	78	75-125		
Nickel	50.6	1.0	mg/kg wet	50.0	13	75	75-125		
Zinc	104	5.0	mg/kg wet	50.0	68	72	75-125		M2
Matrix Spike Dup Analyzed: 11/03/01 (I1J3140-MSD1)									
Chromium	54.9	1.0	mg/kg wet	50.0	18	74	75-125	3	20
Copper	58.4	1.0	mg/kg wet	50.0	21	75	75-125	3	20
Nickel	49.6	1.0	mg/kg wet	50.0	13	73	75-125	2	20
Zinc	101	5.0	mg/kg wet	50.0	68	66	75-125	3	M2

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Project ID: 01204A Catalina NPDES

Report Number: IKJ1098

Sampled: 10/19/01

Received: 10/26/01

METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC %REC	%REC Limits	RPD RPD	RPD Limit	Data Qualifier
---------	--------	-----------------	-------	-------------	---------------	-----------	-------------	---------	-----------	----------------

Batch: I1J2975 Extracted: 10/29/01

Blank Analyzed: 10/29/01 (I1J2975-BLK1)

Percent Solids ND 0.010 %

Duplicate Analyzed: 10/29/01 (I1J2975-DUP1)

Percent Solids 12.4 0.010 %

Source: IKJ0978-01RE1

12 3 20

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Project ID: 01204A Catalina NPDES

Report Number: IKJ1098

Sampled: 10/19/01

Received: 10/26/01

DATA QUALIFIERS AND DEFINITIONS

- M2** The MS and/or MSD were below the acceptance limits due to sample matrix interference. See Blank Spike (LCS).
ND Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.
NR Not reported.
RPD Relative Percent Difference

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**Appendix G-1. Infaunal master species list. Haynes and AES Alamitos L.L.C. generating stations
NPDES, 2001.**

PHYLUM	PHYLUM
Subphylum or Class	Subphylum or Class
Species	Species
CNIDARIA	MOLLUSCA (Cont.)
Anthozoa	Gastropoda
Actiniaria	<i>Acteocina culcitella</i>
<i>Edwardsia</i> sp G MEC 1992 ¹	<i>Acteocina harpa</i>
<i>Epiactis prolifera</i>	Aeolidoidea
<i>Stylatula elongata</i>	Aplysiidae
<i>Zaolutes actius</i>	<i>Barleeria subtenuis</i>
Hydrozoa	<i>Crepidula norrisiarum</i>
<i>Hydractinia</i> sp	<i>Crepidula</i> sp
PLATYHELMINTHES	<i>Crucibulum spinosum</i>
Turbellaria	<i>Cyclostremella dalli</i>
<i>Eurylepta</i> sp	<i>Haminoea virescens</i>
<i>Notoplana</i> sp	<i>Kurtziella plumbea</i>
<i>Pseudoceros</i> sp ²	<i>Odostomia</i> sp D MBC 1980
NEMERTEA	<i>Olivella baetica</i>
Anopla	<i>Philine auriformis</i>
<i>Carinoma mutabilis</i>	<i>Philine</i> sp A SCAMIT 1988
Lineidae	<i>Turbonilla santarosana</i> ¹¹
<i>Tubulanus polymorphus</i> ³	Scaphopoda
Enopla	<i>Cadulus aberrans</i> ¹²
<i>Amphiporus bimaculatus</i>	SIPUNCULA
<i>Amphiporus</i> sp	Phascolosomatidea
Hoplonemertea sp B MEC 1988	<i>Thysanocardia nigra</i>
<i>Monostylifera</i> sp SD1 Pt Loma 1995	ANNELIDA
<i>Paranemertes californica</i> ⁴	Oligochaeta
<i>Tetrastemma</i> sp A SCAMIT 1995	Oligochaeta
<i>Zygonemertes virescens</i>	Polychaeta
Uncertain	<i>Amaeana occidentalis</i>
Nemertea	<i>Ampharete labrops</i>
NEMATODA	<i>Amphicteis scaphobranchiata</i>
Nematoda	Annelida
MOLLUSCA	<i>Aphelochaeta glandaria</i> ¹³
Bivalvia	<i>Aphelochaeta monilaris</i> ¹⁴
Bivalvia	<i>Apopriionospio pygmaea</i>
<i>Cooperella subdiaphana</i>	<i>Arabella semimaculata</i>
<i>Hiatella arctica</i>	<i>Arcteobia cf anticostiensis</i>
<i>Laevicardium substratum</i>	<i>Aricidea (Acmira) catherinae</i> ¹⁵
<i>Leptopecten latiauratus</i>	<i>Aricidea (Acmira) horikoshii</i> ¹⁶
<i>Macoma</i> sp	<i>Aricidea (Aricidea) wassi</i>
<i>Macoma yoldiformis</i>	<i>Armandia brevis</i> ¹⁷
<i>Mactrotoma californica</i> ⁵	Autolytinae
<i>Modiolus</i> sp	<i>Capitella capitata</i> Cmplx
<i>Nuculana taphria</i>	<i>Carazziella</i> sp A SCAMIT 1995
<i>Periploma discus</i>	<i>Chaetozone corona</i>
<i>Petricola carditoides</i>	<i>Chaetozone setosa</i> Cmplx ¹⁸
<i>Rochefortia coani</i> ⁶	<i>Chone mollis</i>
<i>Rochefortia compressa</i> ⁷	<i>Chone</i> sp SD1 Pt. Loma 1997
<i>Rochefortia grippi</i> ⁸	<i>Cirriformia moorei</i>
<i>Rochefortia tumida</i> ⁹	<i>Cirriformia</i> sp
<i>Siliqua lucida</i>	<i>Cossura</i> sp A Phillips 1987
<i>Solen rostriformis</i> ¹⁰	<i>Diopatra</i> sp
<i>Tagelus</i> sp	<i>Diopatra splendidissima</i>
<i>Tagelus subteres</i>	<i>Diopatra tridentata</i>
<i>Tellina modesta</i>	<i>Dipolydora giardi</i>
<i>Theora lubrica</i>	<i>Dipolydora socialis</i> ¹⁹
<i>Thyasira flexuosa</i>	<i>Dorvillea</i> sp
<i>Trachycardium quadrangulatum</i>	<i>Drilonereis longa</i>
	<i>Eteone pigmentata</i>
	<i>Euchone incolor</i>
	<i>Euchone limnicola</i>
	Euclymeninae
	<i>Euclymeninae</i> sp A SCAMIT 1987
	<i>Eumida longicomuta</i> ²⁰

Appendix G-1. (Cont.).

PHYLUM	PHYLUM	
Subphylum or Class	Subphylum or Class	
Species	Species	
ANNELIDA (Cont.).		
Polychaeta	Polychaeta	
<i>Eupolymnia heterobranchia</i>	<i>Sigalion spinosus</i> ³²	
<i>Exogone lourei</i>	<i>Sigambra setosa</i>	
<i>Glycera americana</i>	<i>Sphaerosyllis californiensis</i>	
<i>Glycera brachiopoda</i>	<i>Spio filicornis</i>	
<i>Glycera macrobranchia</i> ²¹	<i>Spiochaetopterus costarum</i>	
<i>Glycinde armigera</i>	<i>Spiophanes berkeleyorum</i>	
<i>Goniada littorea</i>	<i>Spiophanes bombyx</i>	
<i>Goniada maculata</i>	<i>Spiophanes duplex</i> ³³	
<i>Halosydna johnsoni</i>	<i>Sthenelais tertiglabra</i>	
<i>Hesionella mccullochae</i>	<i>Sthenelais veruculosa</i>	
<i>Laonice cirrata</i>	<i>Streblosoma crassibranchia</i>	
<i>Leitoscoloplos puggettensis</i> ²²	<i>Streblosoma sp B SCAMIT 1985</i>	
<i>Levinseria gracilis</i>	<i>Streblospio benedicti</i>	
Lumbrineridae	<i>Syllis (Syllis) gracilis</i>	
<i>Lumbrineris</i> sp	<i>Syllis (Typosyllis) aciculata</i>	
<i>Lumbrineris latreilli</i>	<i>Tenonia priops</i> ³⁴	
<i>Magelona pitelkai</i>	Terebellidae	
<i>Magelona sacculata</i>	<i>Terebellides californica</i>	
<i>Malmgreniella macginitiei</i> ²³	<i>Trypanosyllis</i> sp	
<i>Marpheya sanguinea</i>	ARTHROPODA	
<i>Marpheya</i> sp A Harris & Velarde 1983	Cirripedia	
<i>Mediomastus acutus</i>	<i>Balanus pacificus</i>	
<i>Mediomastus</i> spp	Copepoda	
<i>Melimna oculata</i>	Harpacticoida	
<i>Monticellina cryptica</i> ²⁴	Malacostraca	
<i>Neanthes acuminata</i> Cmplx	<i>Americhelidium rectipalmum</i> ³⁵	
<i>Neosabellaria cementarium</i>	<i>Americhelidium shoemakeri</i> ³⁶	
<i>Nephtys caecoides</i>	<i>Ampelisca brevisimulata</i>	
<i>Nephtys cornuta</i> ²⁵	<i>Amphideutopus oculatus</i>	
<i>Nereis latescens</i>	<i>Ampithoe valida</i>	
<i>Nereis procta</i>	<i>Ampithoidae</i>	
<i>Notomastus</i> sp A SCAMIT 2001	<i>Ancinus granulatus</i>	
<i>Odontosyllis phosphorea</i>	Anomura	
Onuphidae	<i>Aoroides intermedius</i>	
<i>Onuphis</i> sp 1 Pt Loma 1983	<i>Aoroides</i> sp	
<i>Ophyro trocha</i> sp	<i>Argissa hamatipes</i>	
<i>Owenia collaris</i> ²⁶	Brachyura	
<i>Parapriionospio pinnata</i>	<i>Brachyura (megalopa)</i>	
<i>Pectinaria californiensis</i>	<i>Caecognathia crenulatifrons</i> ³⁷	
<i>Pherusa capulata</i>	<i>Cancer</i> sp	
<i>Pholoe glabra</i>	<i>Caprella mendax</i>	
<i>Phyllo doce hartmanae</i>	<i>Caprella</i> sp	
<i>Phyllo doce</i> sp	<i>Cumella californica</i> ³⁸	
Phyllo docidae	<i>Cyclaspis nubila</i>	
<i>Pista agassizi</i>	<i>Cyclaspis</i> sp C SCAMIT 1986	
<i>Pista disjuncta</i> ²⁷	<i>Diastylopsis tenuis</i>	
<i>Pista</i> sp	<i>Edotia sublittoralis</i> ³⁹	
<i>Platyneris bicanaliculata</i>	<i>Elasmopus bampo</i>	
<i>Podarkeopsis glabra</i> ²⁸	<i>Ericthonius brasiliensis</i>	
<i>Podarkeopsis</i> sp A Harris & Velarde 1983	<i>Foxiphalus obtusidens</i>	
<i>Poecilochaetus johnsoni</i>	Gammaridea	
<i>Polycirrus</i> sp A SCAMIT 1995	<i>Gibberosus myersi</i> ⁴⁰	
<i>Polydora cirrosa</i>	<i>Grandidierella japonica</i>	
<i>Polydora cornuta</i>	<i>Hartmanodes hartmanae</i> ⁴¹	
<i>Polydora nuchalis</i>	<i>Hemilamprops californica</i>	
<i>Polyopthalmus pictus</i>	<i>Isocheles pilosus</i>	
<i>Praxillella pacifica</i>	<i>Lamprops carinatus</i>	
<i>Prionospio (Minuspio) lighti</i> ²⁹	<i>Leptostylis calva</i> ⁴²	
<i>Scalibregma californicum</i> ³⁰	<i>Listriella goleta</i>	
<i>Scoletoma</i> sp	<i>Metamysidopsis elongata</i>	
<i>Scoletoma</i> sp B (Harris 1985)	<i>Monocorophium acherusicum</i>	
<i>Scoletoma tetraura</i> Cmplx ³¹	<i>Mysidopsis intii</i>	
<i>Scoloplos armiger</i> Cmplx		

Appendix G-1. (Cont.).

PHYLUM	PHYLUM
Subphylum or Class	Subphylum or Class
Species	Species
ARTHROPODA (Cont.)	ECHINODERMATA
Malacostraca	Ophiuroidea
<i>Neotrypaea californiensis</i> ⁴³	<i>Amphiodia digitata</i>
<i>Ogyrides</i> sp A Roney 1978	<i>Amphiodia psara</i>
<i>Oxyurostylis pacifica</i>	<i>Amphiodia</i> sp
<i>Paracerceis sculpta</i>	Amphiuridae
<i>Paranthura elegans</i>	Ophiuroidea
<i>Photis bifurcata</i>	
<i>Photis brevipes</i>	PHORONA
<i>Photis</i> sp OC1 Diener 1992 ⁴⁴	Phoronida
<i>Pinnixa franciscana</i>	Phoronida
<i>Podocerus fulanus</i>	<i>Phoronis</i> sp
<i>Pyromaria tuberculata</i>	<i>Phoronopsis</i> sp
<i>Rhepoxyinius menziesi</i> ⁴⁵	
<i>Rhepoxyinius</i> sp A SCAMIT 1987	ECTOPROCTA
<i>Rhepoxyinius stenodes</i>	Gymnolaemata
<i>Rudilemboides stenopropodus</i> ⁴⁶	<i>Bowerbankia gracilis</i>
<i>Uromunna ubiquita</i> ⁴⁷	<i>Cryptarachnidium argilla</i>
<i>Zeuxo normani</i>	
Ostracoda	CHORDATA
<i>Cytheridae</i>	Asciidae
<i>Euphilomedes carcharodonta</i>	<i>Agnezia septentrionalis</i>
<i>Euphilomedes longiseta</i>	Hemicordata
<i>Leuroleberis sharpei</i>	<i>Enteropneusta</i> ⁴⁹
<i>Parasterope hulingsi</i>	
<i>Postasterope barnesi</i> ⁴⁸	BRACHIOPODA
<i>Rutiderma rostratum</i>	Inarticulata
Pycnogonida	<i>Glottidia albida</i>
<i>Ammothea hilgendorfi</i>	
<i>Anoplodactylus viridintestinalis</i>	
<i>Tanystylum californicum</i>	

The following footnotes indicate names used in previous surveys:

- 1 Edwardsia sp G of Ljubenkov, *E. sipunculoides*
- 2 Platyhelminthes sp G of MBC
- 3 Tubulanus pellucidus/polymorphus, *T. sp* or *T. spp*
- 4 Paranemertes sp A of SCAMIT
- 5 Mactra californica
- 6 Rochefortia sp A SCAMIT 1988, *Mysella* sp A of SCAMIT
- 7 *Mysella planata*, *Mysella* sp D of SCAMIT
- 8 *Mysella grippi*
- 9 *Mysella turnida*, M. cf. *aleutica*
- 10 *Solen rosaceus*
- 11 Turbonilla sp E of MBC
- 12 Gadila aberrans, *Cadulus fusiformis*
- 13 Aphelochaeta sp C of Dorsey
- 14 Tharyx monilaris, *Tharyx* spp
- 15 Acmina catherinae
- 16 Acmina horikoshii
- 17 Armandia bioculata
- 18 Chaetozone "setosa", C. cf. setosa
- 19 Polydora socialis
- 20 Eumida sp B of SCAMIT
- 21 Glycera convoluta
- 22 Haploscoloplos elongatus
- 23 Harmothoe cf. lunulata
- 24 Monticellina dorsobranchialis, *Tharyx* sp A of SCAMIT
- 25 Nephtys cornuta franciscana
- 26 Owenia fusiformis
- 27 Pista nr. disjuncta
- 28 Gyptis brevipalpa
- 29 Minuspio cimifera, *Prionospio cirrifera*
- 30 Scalibregma inflatum
- 31 Lumbrineris tetraura, L. "tetraura"
- 32 Thalenessa spinosum
- 33 Spiophanes missionensis
- 34 Harmothoe priops
- 35 Synchelidium rectipalmum
- 36 Synchelidium shoemakeri
- 37 Gnathia crenulatifrons
- 38 Cumella sp A Myers & Benedict 1974
- 39 Edotea sublittoralis
- 40 Megaluropus longimerus
- 41 Monoculodes hartmanae
- 42 Leptostylis sp A of MBC
- 43 Callianassa sp
- 44 Photis OC 1 (MEC) 1996
- 45 Paraphoxus epistomus, *Rhepoxyinius epistomus*
- 46 Acuminodeutopus stenopropodus
- 47 Munna ubiquita
- 48 Parasterope barnesi
- 49 Hemicordata

Appendix G-2. Infauna results by station. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001

Phylum	Species	Station												Percent Total
		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	
AR	<i>Monocorophium acherusicum</i>	7	-	2	1	4	3	-	1	-	7	7105	9246	16376 65.11
AR	<i>Ericthonius brasiliensis</i>	-	1	4	-	-	1	-	-	-	-	1213	1587	2806 11.16
AR	<i>Grandidierella japonica</i>	-	1	-	-	-	-	-	-	94	314	523	932 3.71	
AN	<i>Streblospio benedicti</i>	-	-	-	-	-	-	-	-	380	10	240	630 2.50	
AN	<i>Mediomastus acutus</i>	108	22	58	44	44	38	1	13	8	-	-	-	336 1.34
AN	<i>Owenia collaris</i>	15	149	-	-	92	77	-	3	-	-	-	-	336 1.34
AN	<i>Streblosoma</i> sp B SCAMIT 1985	-	-	-	-	-	-	-	-	-	-	115	210	325 1.29
AN	<i>Mediomastus</i> spp	129	13	41	30	10	3	23	19	42	-	-	-	310 1.23
AN	<i>Capitella capitata</i> Cmplx	-	-	-	-	-	-	-	-	6	86	129	221 0.88	
AR	<i>Elasmopus bampo</i>	-	-	-	-	-	-	-	-	-	83	130	213 0.85	
AN	<i>Cirriformia</i> sp	-	-	-	-	-	1	-	-	-	62	107	170 0.68	
AN	<i>Apopriopionospio pygmaea</i>	25	19	11	28	24	24	1	16	17	-	-	-	165 0.66
CN	<i>Actiniania</i>	-	-	-	-	-	1	-	-	-	4	131	136	0.54
AN	<i>Sphaerosyllis californiensis</i>	-	-	-	-	-	-	-	-	-	72	48	120	0.48
AN	<i>Cossura</i> sp A Phillips 1987	-	-	-	-	-	-	101	1	1	-	-	-	103 0.41
AR	<i>Diastylopsis tenuis</i>	15	7	-	20	26	19	-	-	-	-	-	-	87 0.35
AR	<i>Paranthura elegans</i>	1	-	-	-	-	-	-	-	-	59	15	75	0.30
AR	<i>Paracerceis sculpta</i>	1	-	-	-	-	-	-	-	-	24	37	62	0.25
AR	<i>Podocerus fulanus</i>	-	-	-	-	-	-	-	-	-	19	38	57	0.23
AN	<i>Goniada littorea</i>	19	2	1	14	12	3	-	-	3	-	-	-	54 0.21
AN	<i>Spiophanes bombyx</i>	1	9	5	4	5	-	-	28	-	-	-	-	52 0.21
AN	<i>Spiophanes duplex</i>	3	22	8	-	-	2	1	13	2	-	-	-	51 0.20
AN	<i>Polydora cirrosa</i>	37	-	-	-	-	-	-	-	-	12	-	-	49 0.19
MO	<i>Barleelia subtenius</i>	-	-	-	-	-	-	-	-	-	42	6	48	0.19
AN	<i>Spiolifernis</i>	-	-	-	-	-	-	-	-	-	35	7	42	0.17
PL	<i>Notoplana</i> sp	-	-	-	-	-	-	-	-	-	39	1	40	0.16
AN	<i>Monticellina cryptica</i>	3	-	1	1	1	-	14	1	15	-	1	-	37 0.15
AN	<i>Nephtys cornuta</i>	4	-	7	8	3	1	8	2	-	1	-	-	34 0.14
AR	<i>Euphilomedes carcharodonta</i>	1	-	1	14	4	-	3	-	10	-	-	-	33 0.13
AN	<i>Neanthes acuminata</i> Cmplx	-	-	-	-	-	-	-	-	-	22	7	29	0.12
AR	<i>Amphideutopus oculatus</i>	-	-	3	-	-	-	23	1	2	-	-	-	29 0.12
AN	<i>Scopeloma</i> sp	-	-	-	-	-	-	9	-	18	-	-	-	27 0.11
AR	<i>Rhepoxynius menziesi</i>	-	3	6	2	8	7	-	1	-	-	-	-	27 0.11
AN	<i>Neosabellaria cementarium</i>	1	-	-	-	24	1	-	-	-	-	-	-	26 0.10
MO	<i>Tellina modesta</i>	1	1	3	5	3	6	-	3	2	-	-	-	24 0.10
AN	<i>Amaeana occidentalis</i>	-	-	8	2	-	-	-	7	6	-	-	-	23 0.09
AR	<i>Americhelidium shoemakeri</i>	2	1	6	4	1	6	-	1	-	-	-	-	21 0.08
AN	<i>Dipolydora socialis</i>	-	-	-	-	-	-	-	-	-	10	10	20	0.08
AN	<i>Euchone incolor</i>	-	-	-	1	-	-	1	11	6	-	-	-	19 0.08
AN	<i>Leitoscoloplos pugettensis</i>	4	-	3	4	2	1	5	-	-	-	-	-	19 0.08
AN	<i>Nephtys caecoides</i>	4	-	-	-	4	11	-	-	-	-	-	-	19 0.08
AN	<i>Nereis provera</i>	-	-	-	-	-	-	8	3	8	-	-	-	19 0.08
AR	<i>Euphilomedes longisetata</i>	14	-	-	-	-	5	-	-	-	-	-	-	19 0.08
AR	<i>Photis brevipes</i>	4	3	3	-	3	5	1	-	-	-	-	-	19 0.08
MO	<i>Cyclostremella dalli</i>	6	3	-	1	3	6	-	-	-	-	-	-	19 0.08
AN	<i>Aphelochaeta monilaris</i>	-	-	-	-	-	-	18	-	-	-	-	-	18 0.07
AR	<i>Anoplodactylus viridintestinalis</i>	-	-	-	-	-	-	-	-	-	18	-	-	18 0.07
NE	<i>Tubulanus polymorphus</i>	-	-	2	4	-	2	3	4	3	-	-	-	18 0.07
AN	<i>Spiochaetopterus costarum</i>	2	2	-	3	6	-	1	3	-	-	-	-	17 0.07
AR	<i>Pyromia tuberculata</i>	3	1	1	-	7	5	-	-	-	-	-	-	17 0.07
AN	<i>Ophryotrocha</i> sp	-	-	-	-	-	-	-	-	-	7	9	16	0.06
CN	<i>Zaolutus actius</i>	2	9	-	-	3	2	-	-	-	-	-	-	16 0.06
MO	<i>Tagelus</i> sp	-	-	-	-	-	-	-	-	-	-	16	16	16 0.06
AN	<i>Aphelochaeta glandaria</i>	-	1	2	-	-	-	10	-	2	-	-	-	15 0.06
CN	<i>Edwardsia</i> sp G MEC 1992	-	-	-	-	-	-	1	8	6	-	-	-	15 0.06
CO	<i>Enteropneusta</i>	2	6	1	4	-	1	-	-	1	-	-	-	15 0.06
AN	<i>Glycera branchiopoda</i>	-	-	-	-	-	-	-	14	-	-	-	-	14 0.06
AN	<i>Aricidea (Acmina) catherinae</i>	-	-	1	3	2	-	2	1	4	-	-	-	13 0.05
PR	<i>Phorona</i>	-	1	-	-	-	4	2	6	-	-	-	-	13 0.05
AN	<i>Chaetozone setosa</i> Cmplx	-	-	-	2	1	-	-	2	6	-	-	-	11 0.04
AN	<i>Glycine armigera</i>	-	-	2	-	2	-	-	1	6	-	-	-	11 0.04
AN	<i>Parapriopionospio pinnata</i>	-	-	-	-	1	-	3	1	6	-	-	-	11 0.04
AN	<i>Pista disjuncta</i>	-	-	5	-	-	1	1	1	3	-	-	-	11 0.04
AN	<i>Prionospio (Minuspis) lighti</i>	-	-	1	-	-	2	-	8	-	-	-	-	11 0.04
AR	<i>Hartmanodes hartmannae</i>	1	1	-	5	-	4	-	-	-	-	-	-	11 0.04
AR	<i>Rutiderma rostratum</i>	-	-	2	-	1	-	1	3	4	-	-	-	11 0.04
AN	<i>Lumbineridae</i>	5	-	-	-	-	-	1	-	-	2	2	10	0.04
AR	<i>Argissa hamatipes</i>	-	-	-	4	1	2	1	-	2	-	-	-	10 0.04
AR	<i>Leptostylis calva</i>	-	-	-	-	-	1	9	-	-	-	-	-	10 0.04
MO	<i>Cooperella subdiaphana</i>	4	1	-	3	1	-	-	-	1	-	-	-	10 0.04
MO	<i>Macoma yoldiformis</i>	1	-	3	2	-	-	-	2	2	-	-	-	10 0.04
MO	<i>Olivella baetica</i>	-	3	1	-	-	4	-	1	1	-	-	-	10 0.04
PR	<i>Phoronopsis</i> sp	5	1	-	-	4	-	-	-	-	-	-	-	10 0.04
AN	<i>Euclymeninae</i> sp A SCAMIT 1987	-	-	-	1	-	-	8	-	-	-	-	-	9 0.04
AN	<i>Notomastus</i> sp A SCAMIT 2001	-	-	-	1	-	-	8	-	-	-	-	-	9 0.04
MO	<i>Crepidula norrisiarum</i>	-	-	-	-	9	-	-	-	-	-	-	-	9 0.04

Appendix G-2. (Cont.).

Phylum	Species	Station												Percent	
		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	Total	Total
MO	<i>Rochefortia coani</i>	-	-	-	7	-	-	-	1	1	-	-	-	9	0.04
AN	<i>Malmgreniella maccinitiae</i>	-	-	3	-	-	-	1	2	2	-	-	-	8	0.03
AN	<i>Scoletoma tetraura</i> Cmplx	-	-	2	1	1	-	1	-	3	-	-	-	8	0.03
AR	<i>Gibberosus myersi</i>	1	-	1	1	1	4	-	-	-	-	-	-	8	0.03
MO	<i>Crepidula</i> sp	4	-	-	-	-	4	-	-	-	-	-	-	8	0.03
NE	<i>Carinoma mutabilis</i>	1	1	1	1	1	-	1	1	-	-	-	-	8	0.03
AN	<i>Armandia brevis</i>	-	-	1	-	5	1	-	-	-	-	-	-	7	0.03
AN	<i>Euclymeninae</i>	-	-	-	-	2	2	-	-	1	4	-	-	7	0.03
AN	<i>Eumida longicornuta</i>	-	-	1	1	-	2	2	-	-	1	-	-	7	0.03
AN	<i>Oligochaeta</i>	-	-	-	-	-	-	-	1	-	1	5	-	7	0.03
AN	<i>Pectinaria californiensis</i>	-	-	1	1	-	4	1	-	-	-	-	-	7	0.03
AR	<i>Ampithoe valida</i>	-	-	-	-	-	-	-	-	-	-	-	7	7	0.03
AR	<i>Caprella mendax</i>	-	-	-	-	-	-	-	-	-	-	-	7	7	0.03
AR	<i>Gammaridea</i>	-	1	-	1	-	-	5	-	-	-	-	-	7	0.03
MO	<i>Cadulus aberrans</i>	-	-	2	-	-	-	5	-	-	-	-	-	7	0.03
MO	<i>Hiatella arctica</i>	-	-	-	-	-	-	-	-	-	3	4	-	7	0.03
NT	<i>Nematoda</i>	-	-	2	-	-	-	-	2	2	-	-	1	7	0.03
PR	<i>Phoronis</i> sp	2	-	1	-	-	-	1	-	2	-	-	1	7	0.03
AN	<i>Laonice cirrata</i>	-	-	-	-	-	-	5	-	1	-	-	-	6	0.02
AN	<i>Podarkeopsis</i> sp A Harris&Velarde 1983	-	-	-	-	-	-	6	-	-	-	-	-	6	0.02
AN	<i>Polydora cornuta</i>	-	-	-	-	-	-	-	2	1	1	1	1	6	0.02
AR	<i>Lamprops carinatus</i>	5	1	-	-	-	-	-	-	-	-	-	-	6	0.02
MO	<i>Modiolus</i> sp	2	-	-	-	1	-	2	1	-	-	-	-	6	0.02
NE	<i>Paranemertes californica</i>	-	-	1	-	-	1	-	-	3	-	1	-	6	0.02
AN	<i>Amphicteis scaphobranchiata</i>	-	-	-	-	-	-	2	-	3	-	-	-	5	0.02
AN	<i>Arabella semimaculata</i>	-	-	2	-	1	-	-	-	2	-	-	-	5	0.02
AN	<i>Aricidea (Acmina) horikoshii</i>	-	-	-	-	-	-	4	-	1	-	-	-	5	0.02
AN	<i>Chaetozone corona</i>	-	-	1	-	-	-	4	-	-	-	-	-	5	0.02
AN	<i>Cirriformia moorei</i>	2	-	-	-	-	3	-	-	-	-	-	-	5	0.02
AN	<i>Nereis latescens</i>	5	-	-	-	-	-	-	5	-	-	-	-	5	0.02
AN	<i>Terebellides californica</i>	-	-	-	-	-	-	-	-	-	-	-	-	5	0.02
CN	<i>Epiactis prolifera</i>	-	-	-	-	-	-	-	-	-	-	5	-	5	0.02
MO	<i>Odostomia</i> sp D MBC 1980	1	-	-	1	-	-	-	-	3	-	-	-	5	0.02
MO	<i>Periploma discus</i>	-	-	1	2	-	-	2	-	-	-	-	-	5	0.02
NE	<i>Lineidae</i>	-	-	1	-	1	2	-	-	-	-	1	-	5	0.02
NE	<i>Nemertea</i>	-	-	1	-	-	-	-	-	-	3	1	-	5	0.02
AN	<i>Dipolydora giardi</i>	-	-	-	-	-	-	-	-	-	4	-	4	0.02	
AN	<i>Lumbrineris latreilli</i>	-	-	4	-	-	-	-	-	-	-	-	-	4	0.02
AN	<i>Marphysa sanguinea</i>	-	-	-	-	-	-	-	-	-	-	4	-	4	0.02
AN	<i>Melinna oculata</i>	-	-	-	-	-	-	4	-	-	-	-	-	4	0.02
AN	<i>Phyllocoete hartmanae</i>	-	1	-	-	-	-	-	3	-	-	-	-	4	0.02
AN	<i>Scalibregma californicum</i>	-	-	-	-	-	-	1	3	-	-	-	-	4	0.02
AN	<i>Syllis (Syllis) gracilis</i>	-	-	-	-	-	-	-	-	-	4	-	-	4	0.02
AR	<i>Aoroides intermedius</i>	-	-	-	-	4	-	-	-	-	-	-	-	4	0.02
AR	<i>Hemilamprops californica</i>	-	-	-	-	-	-	-	4	-	-	-	-	4	0.02
AR	<i>Parasterope hulingsi</i>	-	-	-	-	1	1	-	1	1	-	-	-	4	0.02
AR	<i>Zeuxo normani</i>	-	-	-	-	-	-	-	-	-	3	1	-	4	0.02
EC	<i>Amphiadia digitata</i>	-	-	2	-	1	-	-	1	1	-	-	-	4	0.02
EC	<i>Amphiuridae</i>	1	-	2	-	1	-	-	-	-	-	-	-	4	0.02
MO	<i>Macoma</i> sp	1	-	-	2	1	-	-	-	-	-	-	-	4	0.02
MO	<i>Mactrotoma californica</i>	2	-	-	2	-	-	-	-	-	-	-	-	4	0.02
MO	<i>Nuculana taphria</i>	-	-	-	-	-	-	4	-	-	-	-	-	4	0.02
MO	<i>Rochefortia compressa</i>	-	-	3	1	-	-	-	-	-	-	-	-	4	0.02
AN	<i>Ampharete labrops</i>	-	-	1	-	2	-	-	-	-	-	-	-	3	0.01
AN	<i>Aricidea (Aricidea) wassi</i>	-	-	-	-	-	-	-	1	2	-	-	-	3	0.01
AN	<i>Chone</i> sp SD1 Pt. Lorna 1997	-	2	-	-	1	-	-	-	-	-	-	-	3	0.01
AN	<i>Diopatra tridentata</i>	-	-	-	-	-	2	1	-	-	-	-	-	3	0.01
AN	<i>Exogone lourei</i>	-	-	1	-	-	-	-	2	-	-	-	-	3	0.01
AN	<i>Glycera americana</i>	-	-	-	-	-	-	3	-	-	-	-	-	3	0.01
AN	<i>Goniada maculata</i>	-	-	-	1	-	-	-	-	2	-	-	-	3	0.01
AN	<i>Levinsenia gracilis</i>	-	-	-	-	-	-	-	-	3	-	-	-	3	0.01
AN	<i>Scoletoma</i> sp B (Harris 1985)	-	-	-	-	-	2	-	1	-	-	-	-	3	0.01
AN	<i>Sthenelais tertiglabra</i>	1	-	-	-	-	-	-	-	2	-	-	-	3	0.01
AN	<i>Syllis (Typosyllis) aciculata</i>	1	-	-	-	1	-	-	1	-	-	-	-	3	0.01
AR	<i>Oxyurostylis pacifica</i>	-	-	2	1	-	-	-	-	-	-	-	-	3	0.01
AR	<i>Rhepoxynius</i> sp A SCAMIT 1987	-	3	-	-	-	-	-	1	2	-	-	-	3	0.01
AR	<i>Rudilemboides stenopropodus</i>	-	-	-	-	-	-	-	1	2	-	-	-	3	0.01
AR	<i>Uromunna ubiquita</i>	-	1	-	-	-	-	1	-	1	-	-	-	3	0.01
CN	<i>Hydractinia</i> sp	-	-	-	-	3	-	-	-	-	-	-	-	3	0.01
MO	<i>Solen rostriformis</i>	-	3	-	-	-	-	-	-	-	-	-	-	3	0.01
AN	<i>Chone mollis</i>	-	-	-	1	-	-	1	-	-	-	-	-	2	0.01
AN	<i>Dorvillea</i> sp	-	-	-	-	-	-	-	2	-	-	-	-	2	0.01
AN	<i>Eteone pigmentata</i>	-	-	-	-	-	-	-	-	2	-	-	-	2	0.01
AN	<i>Glycera macrobranchia</i>	-	1	-	-	-	1	-	-	-	-	-	-	2	0.01
AN	<i>Marphysa</i> sp A Harris & Velarde 1983	-	-	-	-	-	-	1	-	-	-	1	-	2	0.01
AN	<i>Onuphis</i> sp 1 Pt Lorna 1983	-	-	-	1	-	-	-	-	1	-	-	-	2	0.01

Appendix G-2. (Cont.).

Phylum	Species	Station												Percent	
		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	Total	Total
AN	<i>Platyneis bicanaliculata</i>	2	-	-	-	-	-	-	-	-	-	-	-	2	0.01
AN	<i>Podarceopsis glabra</i>	-	-	-	-	-	-	2	-	-	-	-	-	2	0.01
AN	<i>Polyopthalmus pictus</i>	-	-	-	-	-	-	-	-	-	1	1	-	2	0.01
AN	<i>Sigalion spinosus</i>	-	-	-	-	-	-	2	-	-	-	-	-	2	0.01
AN	<i>Sigambla setosa</i>	-	-	-	-	-	-	2	-	-	-	-	-	2	0.01
AN	Terebellidae	-	-	-	-	-	-	2	-	-	-	-	-	2	0.01
AR	<i>Americhelidium rectipalmum</i>	2	-	-	-	-	-	-	-	-	-	-	-	2	0.01
AR	<i>Ammothea hilgendorfi</i>	-	-	-	-	-	-	-	-	-	1	1	-	2	0.01
AR	Ampithoidae	-	-	-	-	-	-	-	-	-	2	-	-	2	0.01
AR	Anomura	-	1	-	1	-	-	-	-	-	-	-	-	2	0.01
AR	<i>Edotia sublittoralis</i>	-	-	-	-	-	-	1	-	1	-	-	-	2	0.01
AR	Harpacticoida	-	-	-	-	-	-	1	1	-	-	-	-	2	0.01
AR	<i>Leuroleberis sharpei</i>	-	1	-	-	-	-	1	-	-	-	-	-	2	0.01
AR	<i>Listriella goleta</i>	-	-	-	-	-	-	-	-	2	-	-	-	2	0.01
AR	<i>Neotrypaea californiensis</i>	-	-	-	-	2	-	-	-	-	-	-	-	2	0.01
AR	<i>Pinnixa franciscana</i>	-	-	-	-	-	-	-	-	2	-	-	-	2	0.01
AR	<i>Postasterope barnesi</i>	-	-	-	-	-	-	-	-	-	2	-	-	2	0.01
BC	<i>Glottidia albida</i>	-	-	-	-	-	-	1	-	1	-	-	-	2	0.01
CO	<i>Agnezia septentrionalis</i>	-	-	-	-	-	-	-	2	-	-	-	-	2	0.01
EC	<i>Amphiodia</i> sp	-	-	1	-	-	-	1	-	-	-	-	-	2	0.01
EP	<i>Cryptoaechnidium argilla</i>	1	-	-	-	1	-	-	-	-	-	-	-	2	0.01
MO	Bivalvia	1	-	-	-	-	-	-	-	-	-	1	2	0.01	
MO	<i>Kurtziella plumbea</i>	-	-	-	-	2	-	-	-	-	-	-	-	2	0.01
MO	<i>Laevicardium substriatum</i>	-	-	-	-	-	-	-	-	-	-	2	2	0.01	
MO	<i>Leptopecten latiauratus</i>	-	-	-	-	2	-	-	-	-	-	-	-	2	0.01
MO	<i>Siliqua lucida</i>	1	-	1	-	-	-	-	-	-	-	-	-	2	0.01
MO	<i>Turbanilla santarosana</i>	1	-	-	-	-	1	-	-	-	-	-	-	2	0.01
NE	<i>Monostylifera</i> sp SD1 Pt. Loma 1995	-	-	-	-	-	-	-	2	-	-	-	-	2	0.01
NE	<i>Tetrasymme</i> sp A SCAMIT 1995	-	-	-	1	-	-	-	-	1	-	-	-	2	0.01
AN	Annelida	-	-	-	-	-	-	-	-	-	1	-	1	0.00	
AN	<i>Arctobia</i> cf <i>anticostiensis</i>	-	-	-	-	-	-	-	1	-	-	-	1	0.00	
AN	Autolytinae	-	-	-	-	-	-	-	-	-	1	-	1	0.00	
AN	<i>Carazzella</i> sp A SCAMIT 1995	-	-	-	-	-	1	-	-	-	-	-	-	1	0.00
AN	<i>Diopatra</i> sp	-	-	-	1	-	-	-	-	-	-	-	-	1	0.00
AN	<i>Diopatra splendidissima</i>	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00
AN	<i>Dironereis longa</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
AN	<i>Euchone limnicola</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
AN	<i>Eupolynnia heterobranchia</i>	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00
AN	<i>Halosydna johnsoni</i>	-	-	-	-	-	-	-	-	-	1	-	1	0.00	
AN	<i>Hesionella mccullochae</i>	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00
AN	<i>Lumbrineris</i> sp	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
AN	<i>Magelona pitelkai</i>	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00
AN	<i>Magelona sacculata</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
AN	<i>Odontosyllis phosphorea</i>	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00
AN	Onuphidae	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
AN	<i>Pherusa capulata</i>	-	-	-	-	-	-	-	-	-	-	1	1	0.00	
AN	<i>Phloe glabra</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
AN	<i>Phyllocopte</i> sp	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00
AN	Phyllocoptidae	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00
AN	<i>Pista agassizi</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
AN	<i>Pista</i> sp	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00
AN	<i>Poecilochaetus johnsoni</i>	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00
AN	<i>Polycirrus</i> sp A SCAMIT 1995	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00
AN	<i>Polydora nuchalis</i>	-	-	-	-	-	-	-	-	-	-	1	1	0.00	
AN	<i>Praxillella pacifica</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
AN	<i>Scoloplos armiger</i> Cmplx	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00
AN	<i>Spiophanes berkeleyorum</i>	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00
AN	<i>Sthenelais veruculosa</i>	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00
AN	<i>Streblosoma crassibranchia</i>	-	-	-	-	-	1	-	-	-	-	-	-	1	0.00
AN	<i>Tenoria priops</i>	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00
AN	<i>Trypanosyllis</i> sp	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00
AR	<i>Ampelisca brevisimulata</i>	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00
AR	<i>Ancinus granulatus</i>	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00
AR	<i>Aoroides</i> sp	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00
AR	<i>Balanus pacificus</i>	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00
AR	Brachyura	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00
AR	Brachyura (megalopa)	-	-	-	-	-	1	-	-	-	-	-	-	1	0.00
AR	<i>Caecognathia crenulatitrons</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
AR	<i>Cancer</i> sp	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00
AR	<i>Caprella</i> sp	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00
AR	<i>Cumella californica</i>	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00
AR	<i>Cyclaspis nubila</i>	-	-	-	1	-	-	-	-	-	-	-	-	1	0.00
AR	<i>Cyclaspis</i> sp C SCAMIT 1986	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00
AR	Cytheridae	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00
AR	<i>Foxiphilus obtusidens</i>	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00
AR	<i>Isocheles pilosus</i>	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00

Appendix G-2. (Cont.).

Phylum	Species	Station												Percent	
		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	Total	Total
AR	<i>Metamysidopsis elongata</i>	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00
AR	<i>Mysidopsis intii</i>	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00
AR	<i>Ogyrides</i> sp A Roney 1978	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00
AR	<i>Photis bifurcata</i>	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00
AR	<i>Photis</i> sp OC1 Diener 1992	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00
AR	<i>Rhepoxyrius stenodes</i>	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00
AR	<i>Tanystylum californicum</i>	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00
CN	<i>Stylatula elongata</i>	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00
EC	<i>Amphiodia psara</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
EC	<i>Ophiuroidea</i>	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00
MO	<i>Acteocina culicella</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
MO	<i>Acteocina harpa</i>	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00
MO	<i>Aeolidida</i>	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00
MO	<i>Aplysiidae</i>	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00
MO	<i>Crucibulum spinosum</i>	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00
MO	<i>Haminoea virescens</i>	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00
MO	<i>Petricola carditoides</i>	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00
MO	<i>Philine auriformis</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
MO	<i>Philine</i> sp A SCAMIT 1988	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
MO	<i>Rochefortia grippi</i>	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00
MO	<i>Rochefortia tumida</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
MO	<i>Tagelus subteres</i>	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00
MO	<i>Theora lubrica</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
MO	<i>Thyasira flexuosa</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
MO	<i>Trachycardium quadrangulum</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
NE	<i>Amphiporus bimaculatus</i>	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00
NE	<i>Amphiporus</i> sp	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00
NE	<i>Hoploneurtea</i> sp B MEC 1988	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00
NE	<i>Zygonemertes virescens</i>	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00
PL	<i>Eurylepta</i> sp	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00
PL	<i>Pseudoceros</i> sp	-	-	-	-	-	-	-	-	-	-	-	1	1	0.00
SI	<i>Thysanocardia nigra</i>	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00
Number of individuals		469	308	237	241	356	276	357	220	257	503	9389	12538	25151	
Number of species		54	46	60	45	59	47	76	65	66	9	47	41	260	
Diversity (H')		2.67	2.29	3.15	3.02	3.03	2.88	3.28	3.52	3.59	0.78	1.02	1.07	1.76	

Note: 0.00 = < 0.005

Appendix G-3. Infaunal data by station and replicate. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Station B1

Phylum	Species	Replicate				Total	Percent Composition	Density No./m ²
		B1-I	B1-II	B1-III	B1-IV			
AN	<i>Mediomastus</i> spp	34	37	19	39	129	27.51	322.5
AN	<i>Mediomastus acutus</i>	25	12	13	58	108	23.03	270.0
AN	<i>Polydora cirrosa</i>	2	4	13	18	37	7.89	92.5
AN	<i>Apoprionospio pygmaea</i>	12	8	3	2	25	5.33	62.5
AN	<i>Goniada littorea</i>	3	6	6	4	19	4.05	47.5
AN	<i>Owenia collaris</i>	1	3	3	8	15	3.20	37.5
AR	<i>Diastylopsis tenuis</i>	6	3	4	2	15	3.20	37.5
AR	<i>Euphilomedes longiseta</i>	1	2	8	3	14	2.99	35.0
AR	<i>Monocorophium acherusicum</i>	3	1	-	3	7	1.49	17.5
MO	<i>Cyclostremella dalli</i>	2	-	1	3	6	1.28	15.0
AN	Lumbrineridae	1	-	3	1	5	1.07	12.5
AN	<i>Nereis latescens</i>	2	-	1	2	5	1.07	12.5
AR	<i>Lamprops carinatus</i>	1	-	1	3	5	1.07	12.5
PR	<i>Phoronopsis</i> sp	2	-	-	3	5	1.07	12.5
AN	<i>Leitoscoloplos pugettensis</i>	-	-	1	3	4	0.85	10.0
AN	<i>Nephtys caecoides</i>	1	-	2	1	4	0.85	10.0
AN	<i>Nephtys cornuta</i>	-	-	2	2	4	0.85	10.0
AR	<i>Photis brevipes</i>	2	-	2	-	4	0.85	10.0
MO	<i>Cooperella subdiaphana</i>	1	-	1	2	4	0.85	10.0
MO	<i>Crepidula</i> sp	-	1	2	1	4	0.85	10.0
AN	<i>Monticellina cryptica</i>	-	2	-	1	3	0.64	7.5
AN	<i>Spiophanes duplex</i>	-	-	-	3	3	0.64	7.5
AR	<i>Pyromaria tuberculata</i>	-	-	2	1	3	0.64	7.5
AN	<i>Cirriformia moorei</i>	-	1	1	-	2	0.43	5.0
AN	<i>Platynereis bicanaliculata</i>	-	1	1	-	2	0.43	5.0
AN	<i>Spiochaetopterus costarum</i>	-	1	1	-	2	0.43	5.0
AR	<i>Americhelidium rectipalmum</i>	2	-	-	-	2	0.43	5.0
AR	<i>Americhelidium shoemakeri</i>	1	-	1	-	2	0.43	5.0
CN	<i>Zacolutus actius</i>	1	1	-	-	2	0.43	5.0
CO	Enteropneusta	1	-	-	1	2	0.43	5.0
MO	<i>Mactrotoma californica</i>	-	-	-	2	2	0.43	5.0
MO	<i>Modiolus</i> sp	-	-	1	1	2	0.43	5.0
PR	<i>Phoronis</i> sp	-	-	1	1	2	0.43	5.0
AN	<i>Diopatra splendidissima</i>	-	1	-	-	1	0.21	2.5
AN	<i>Neosabellaria cementarium</i>	-	1	-	-	1	0.21	2.5
AN	<i>Spiophanes bombyx</i>	-	-	-	1	1	0.21	2.5
AN	<i>Sthenelaia tertiglabra</i>	-	-	-	1	1	0.21	2.5
AN	<i>Syllis (Typosyllis) aciculata</i>	-	1	-	-	1	0.21	2.5
AR	<i>Aoroides</i> sp	-	-	-	1	1	0.21	2.5
AR	<i>Euphilomedes carcharodonta</i>	1	-	-	-	1	0.21	2.5
AR	<i>Gibberosus myersi</i>	1	-	-	-	1	0.21	2.5
AR	<i>Hartmanodes hartmanae</i>	1	-	-	-	1	0.21	2.5
AR	<i>Paracerceis sculpta</i>	1	-	-	-	1	0.21	2.5
AR	<i>Paranthuria elegans</i>	-	-	1	-	1	0.21	2.5
EC	Amphiuridae	-	-	-	1	1	0.21	2.5
EP	<i>Cryptorachnidium argilla</i>	-	-	1	-	1	0.21	2.5
MO	<i>Bivalvia</i>	-	-	1	-	1	0.21	2.5
MO	<i>Macoma</i> sp	-	1	-	-	1	0.21	2.5
MO	<i>Macoma yoldiformis</i>	1	-	-	-	1	0.21	2.5
MO	<i>Odostomia</i> sp D MBC 1980	-	-	-	1	1	0.21	2.5
MO	<i>Siliqua lucida</i>	-	-	1	-	1	0.21	2.5
MO	<i>Tellina modesta</i>	-	-	1	-	1	0.21	2.5
MO	<i>Turbonilla santarosana</i>	-	-	-	1	1	0.21	2.5
NE	<i>Carinoma mutabilis</i>	-	-	1	-	1	0.21	2.5

Summary

Parameter	Replicate				Station Total	Replicate	
	B1-I	B1-II	B1-III	B1-IV		Mean	S.D.
Number of individuals	109	87	99	174	469	117.3	38.9
Number of species	26	19	31	32	54	27.0	5.9
Diversity (H')	2.34	2.10	2.85	2.38	2.67	2.42	0.31

Appendix G-3. (Cont.).

Station B2

Phylum	Species	Replicate				Total	Percent Composition	Density No./m ²
		B2-I	B2-II	B2-III	B2-IV			
AN	<i>Owenia collaris</i>	8	49	57	35	149	48.38	372.5
AN	<i>Mediomastus acutus</i>	5	9	4	4	22	7.14	55.0
AN	<i>Spiophanes duplex</i>	1	12	7	2	22	7.14	55.0
AN	<i>Apopriionospio pygmaea</i>	3	6	5	5	19	6.17	47.5
AN	<i>Mediomastus</i> spp	-	6	5	2	13	4.22	32.5
AN	<i>Spiophanes bombyx</i>	1	3	3	2	9	2.92	22.5
CN	<i>Zaolotus actius</i>	1	1	3	4	9	2.92	22.5
AR	<i>Diastylopsis tenuis</i>	1	2	1	3	7	2.27	17.5
CO	<i>Enteropneusta</i>	1	4	1	-	6	1.95	15.0
AR	<i>Photis brevipes</i>	-	2	-	1	3	0.97	7.5
AR	<i>Rhepoxyrinus menziesi</i>	2	-	-	1	3	0.97	7.5
AR	<i>Rhepoxyrinus</i> sp A SCAMIT 1987	2	-	-	1	3	0.97	7.5
MO	<i>Cyclostremella dalli</i>	-	1	-	2	3	0.97	7.5
MO	<i>Olivella baetica</i>	-	3	-	-	3	0.97	7.5
MO	<i>Solen rostriformis</i>	2	-	1	-	3	0.97	7.5
AN	<i>Chone</i> sp SD1 Pt. Loma 1997	2	-	-	-	2	0.65	5.0
AN	<i>Goniada littorea</i>	1	-	-	1	2	0.65	5.0
AN	<i>Spiochaetopterus costarum</i>	1	-	-	1	2	0.65	5.0
AN	<i>Aphelochaeta glandaria</i>	1	-	-	-	1	0.32	2.5
AN	<i>Eumida longicornuta</i>	-	1	-	-	1	0.32	2.5
AN	<i>Glycera macrobranchia</i>	-	1	-	-	1	0.32	2.5
AN	<i>Magelona pitelkai</i>	-	-	-	1	1	0.32	2.5
AN	<i>Phyllodoces hartmanae</i>	-	-	1	-	1	0.32	2.5
AN	<i>Pista</i> sp	-	-	-	1	1	0.32	2.5
AR	<i>Americhelidium shoemakeri</i>	-	-	-	1	1	0.32	2.5
AR	<i>Ancinus granulatus</i>	1	-	-	-	1	0.32	2.5
AR	<i>Anomura</i>	1	-	-	-	1	0.32	2.5
AR	<i>Cancer</i> sp	-	1	-	-	1	0.32	2.5
AR	<i>Ericthonius brasiliensis</i>	-	1	-	-	1	0.32	2.5
AR	<i>Gammaridea</i>	-	-	1	-	1	0.32	2.5
AR	<i>Grandidierella japonica</i>	-	1	-	-	1	0.32	2.5
AR	<i>Hartmanodes hartmanae</i>	1	-	-	-	1	0.32	2.5
AR	<i>Isocheles pilosus</i>	1	-	-	-	1	0.32	2.5
AR	<i>Lamprops carinatus</i>	-	1	-	-	1	0.32	2.5
AR	<i>Leuroleberis sharpei</i>	-	1	-	-	1	0.32	2.5
AR	<i>Metamysidopsis elongata</i>	-	1	-	-	1	0.32	2.5
AR	<i>Mysidopsis intii</i>	1	-	-	-	1	0.32	2.5
AR	<i>Pyromia tuberculata</i>	-	-	-	1	1	0.32	2.5
AR	<i>Uromunna ubiquita</i>	-	1	-	-	1	0.32	2.5
EC	<i>Ophiuroidea</i>	-	1	-	-	1	0.32	2.5
MO	<i>Cooperella subdiaphana</i>	-	-	-	1	1	0.32	2.5
MO	<i>Tellina modesta</i>	-	-	-	1	1	0.32	2.5
NE	<i>Carinoma mutabilis</i>	-	-	-	1	1	0.32	2.5
PR	<i>Phorona</i>	-	1	-	-	1	0.32	2.5
PR	<i>Phoronopsis</i> sp	-	-	1	-	1	0.32	2.5
SI	<i>Thysanocardia nigra</i>	-	1	-	-	1	0.32	2.5

Summary

Parameter	Replicate				Station Total	Replicate	
	B2-I	B2-II	B2-III	B2-IV		Mean	S.D.
Number of individuals	37	110	90	71	308	77.0	31.1
Number of species	20	24	13	21	46	19.5	4.7
Diversity (H')	2.70	2.18	1.47	2.12	2.29	2.12	0.50

Appendix G-3. (Cont.).

Station B3

Phylum	Species	Replicate				Total	Percent Composition	Density No./m ²
		B3-I	B3-II	B3-III	B3-IV			
AN	<i>Mediomastus acutus</i>	14	15	15	14	58	24.47	145.0
AN	<i>Mediomastus</i> spp	1	7	4	29	41	17.30	102.5
AN	<i>Apopriionospio pygmaea</i>	2	2	6	1	11	4.64	27.5
AN	<i>Amaeana occidentalis</i>	1	3	2	2	8	3.38	20.0
AN	<i>Spiophanes duplex</i>	1	-	2	5	8	3.38	20.0
AN	<i>Nephtys cornuta</i>	-	4	2	1	7	2.95	17.5
AR	<i>Americhelidium shoemakeri</i>	-	1	3	2	6	2.53	15.0
AR	<i>Rhepoxynius menziesi</i>	3	1	1	1	6	2.53	15.0
AN	<i>Pista disjuncta</i>	2	-	2	1	5	2.11	12.5
AN	<i>Spiophanes bombyx</i>	-	2	1	2	5	2.11	12.5
AN	<i>Lumbrineris latreilli</i>	-	-	-	4	4	1.69	10.0
AR	<i>Erithonius brasiliensis</i>	-	1	1	2	4	1.69	10.0
AN	<i>Leitoscoloplos pugettensis</i>	-	-	2	1	3	1.27	7.5
AN	<i>Malmgreniella macginittiei</i>	1	1	-	1	3	1.27	7.5
AR	<i>Amphideutopus oculatus</i>	-	1	2	-	3	1.27	7.5
AR	<i>Photis brevipes</i>	-	-	-	3	3	1.27	7.5
MO	<i>Macoma yoldiformis</i>	1	1	1	-	3	1.27	7.5
MO	<i>Rochefortia compressa</i>	2	-	1	-	3	1.27	7.5
MO	<i>Tellina modesta</i>	1	1	-	1	3	1.27	7.5
AN	<i>Aphelochaeta glandaria</i>	-	1	1	-	2	0.84	5.0
AN	<i>Arabella semimaculata</i>	-	2	-	-	2	0.84	5.0
AN	<i>Glycinde armigera</i>	-	1	-	1	2	0.84	5.0
AN	<i>Scoletoma tetraura</i> Cmplx	-	-	-	2	2	0.84	5.0
AR	<i>Monocorophium acherusicum</i>	-	1	-	1	2	0.84	5.0
AR	<i>Oxyurostylis pacifica</i>	-	1	-	1	2	0.84	5.0
AR	<i>Rutiderma rostratum</i>	-	-	1	1	2	0.84	5.0
EC	<i>Amphiodia digitata</i>	-	-	1	1	2	0.84	5.0
EC	<i>Amphiuridae</i>	-	1	1	-	2	0.84	5.0
MO	<i>Cadulus aberrans</i>	-	1	-	1	2	0.84	5.0
NE	<i>Tubulanus polymorphus</i>	-	-	-	2	2	0.84	5.0
NT	<i>Nematoda</i>	-	-	-	2	2	0.84	5.0
AN	<i>Ampharete labrops</i>	-	-	-	1	1	0.42	2.5
AN	<i>Aricidea (Acmira) catherinae</i>	-	-	1	-	1	0.42	2.5
AN	<i>Armandia brevis</i>	-	-	-	1	1	0.42	2.5
AN	<i>Chaetozone corona</i>	-	1	-	-	1	0.42	2.5
AN	<i>Diopatra</i> sp	-	-	1	-	1	0.42	2.5
AN	<i>Eumida longicornuta</i>	-	-	1	-	1	0.42	2.5
AN	<i>Exogone ligurei</i>	-	1	-	-	1	0.42	2.5
AN	<i>Goniada littorea</i>	-	1	-	-	1	0.42	2.5
AN	<i>Monticellina cryptica</i>	-	1	-	-	1	0.42	2.5
AN	<i>Odontosyllis phosphorea</i>	-	-	-	1	1	0.42	2.5
AN	<i>Pectinaria californiensis</i>	-	1	-	-	1	0.42	2.5
AN	<i>Prionospio (Miruspio) lighti</i>	1	-	-	-	1	0.42	2.5
AR	<i>Cumella californica</i>	-	-	1	-	1	0.42	2.5
AR	<i>Euphilomedes carcharodonta</i>	-	-	-	1	1	0.42	2.5
AR	<i>Gibberosus myersi</i>	-	-	-	1	1	0.42	2.5
AR	<i>Pyromia tuberculata</i>	-	-	-	1	1	0.42	2.5
AR	<i>Tanystylum californicum</i>	-	-	-	1	1	0.42	2.5
CO	<i>Enteropneusta</i>	1	-	-	-	1	0.42	2.5
EC	<i>Amphiodia</i> sp	-	1	-	-	1	0.42	2.5
MO	<i>Aeolidoidea</i>	-	-	-	1	1	0.42	2.5
MO	<i>Olivella baetica</i>	-	-	-	1	1	0.42	2.5
MO	<i>Periploma discus</i>	-	1	-	-	1	0.42	2.5
MO	<i>Siliqua lucida</i>	-	-	-	1	1	0.42	2.5
NE	<i>Carinoma mutabilis</i>	-	-	-	1	1	0.42	2.5
NE	<i>Lineidae</i>	-	-	-	1	1	0.42	2.5
NE	<i>Nemertea</i>	-	-	1	-	1	0.42	2.5
NE	<i>Paranemertes californica</i>	-	-	1	-	1	0.42	2.5
NE	<i>Tetrastemma</i> sp A SCAMIT 1995	-	-	-	1	1	0.42	2.5
PR	<i>Phoronis</i> sp	-	-	1	-	1	0.42	2.5

Summary

Parameter	Replicate				Station	Replicate		
	B3-I	B3-II	B3-III	B3-IV		Total	Mean	S.D.
Number of individuals	31	55	56	95	237	59.3	26.5	
Number of species	13	27	26	38	60	26.0	10.2	
Diversity (H')	2.00	2.78	2.80	2.86	3.15	2.61	0.41	

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Appendix G-3. (Cont.).

Station B4

Phylum Species	Replicate				Total	Percent Composition	Density No./m ²
	B4-I	B4-II	B4-III	B4-IV			
AN <i>Mediomastus acutus</i>	3	11	18	12	44	18.26	110.0
AN <i>Mediomastus</i> spp	7	18	2	3	30	12.45	75.0
AN <i>Apopionospio pygmaea</i>	6	10	8	4	28	11.62	70.0
AR <i>Diastylopsis tenuis</i>	5	7	4	4	20	8.30	50.0
AN <i>Goniada littorea</i>	4	5	5	-	14	5.81	35.0
AR <i>Euphilomedes carcharodonta</i>	1	3	7	3	14	5.81	35.0
AN <i>Nephtys cornuta</i>	2	2	3	1	8	3.32	20.0
MO <i>Rocheftoria coani</i>	7	-	-	-	7	2.90	17.5
AR <i>Hartmanodes hartmanae</i>	-	2	3	-	5	2.07	12.5
MO <i>Tellina modesta</i>	1	1	1	2	5	2.07	12.5
AN <i>Leptoscoloplos pugettensis</i>	1	-	-	3	4	1.66	10.0
AN <i>Spiophanes bombyx</i>	1	2	-	1	4	1.66	10.0
AR <i>Americhelidium shoemakeri</i>	1	1	1	1	4	1.66	10.0
AR <i>Argissa hematipes</i>	1	2	1	-	4	1.66	10.0
CO <i>Enteropneusta</i>	-	2	-	2	4	1.66	10.0
NE <i>Tubulanus polymorphus</i>	1	1	-	2	4	1.66	10.0
AN <i>Aricidea (Acmira) catherinae</i>	-	2	-	1	3	1.24	7.5
AN <i>Spiochaetopterus costarum</i>	1	2	-	-	3	1.24	7.5
MO <i>Cooperella subdiaphana</i>	2	-	1	-	3	1.24	7.5
AN <i>Amaeana occidentalis</i>	2	-	-	-	2	0.83	5.0
AN <i>Chaetozone setosa</i> Cmplx	-	1	1	-	2	0.83	5.0
AR <i>Rhepoxynius menziesi</i>	-	-	-	2	2	0.83	5.0
MO <i>Macoma</i> sp	-	1	-	1	2	0.83	5.0
MO <i>Macoma yoldiformis</i>	-	-	2	-	2	0.83	5.0
MO <i>Mactrotoma californica</i>	-	-	2	-	2	0.83	5.0
MO <i>Periploma discus</i>	-	1	1	-	2	0.83	5.0
AN <i>Chone mollis</i>	-	1	-	-	1	0.41	2.5
AN <i>Euchone incolor</i>	-	1	-	-	1	0.41	2.5
AN <i>Euclymeninae</i> sp A SCAMIT 1987	-	1	-	-	1	0.41	2.5
AN <i>Goniada maculata</i>	1	-	-	-	1	0.41	2.5
AN <i>Monticellina cryptica</i>	1	-	-	-	1	0.41	2.5
AN <i>Notomastus</i> sp A SCAMIT 2001	1	-	-	-	1	0.41	2.5
AN <i>Onuphis</i> sp 1 Pt Loma 1983	-	-	1	-	1	0.41	2.5
AN <i>Pectinaria californiensis</i>	-	1	-	-	1	0.41	2.5
AN <i>Scoletoma tetraura</i> Cmplx	1	-	-	-	1	0.41	2.5
AR <i>Anomura</i>	-	-	1	-	1	0.41	2.5
AR <i>Cyclespis nubila</i>	-	1	-	-	1	0.41	2.5
AR <i>Gammaridea</i>	1	-	-	-	1	0.41	2.5
AR <i>Gibberosus myersi</i>	1	-	-	-	1	0.41	2.5
AR <i>Monocorophium acherusicum</i>	-	1	-	-	1	0.41	2.5
AR <i>Oxyurostylis pacifica</i>	1	-	-	-	1	0.41	2.5
MO <i>Cyclostremella dalli</i>	-	-	1	-	1	0.41	2.5
MO <i>Odostomia</i> sp D MBC 1980	-	1	-	-	1	0.41	2.5
MO <i>Rocheftoria compressa</i>	1	-	-	-	1	0.41	2.5
NE <i>Carinoma mutabilis</i>	1	-	-	-	1	0.41	2.5

Summary

Parameter	Replicate				Station Total	Replicate	
	B4-I	B4-II	B4-III	B4-IV		Mean	S.D.
Number of individuals	55	81	63	42	241	60.3	16.3
Number of species	26	26	19	15	45	21.5	5.4
Diversity (H')	2.93	2.71	2.45	2.40	3.02	2.62	0.25

Appendix G-3. (Cont.).

Station B5

Phylum Species	Replicate				Total	Percent Composition	Density No./m ²
	B5-I	B5-II	B5-III	B5-IV			
AN <i>Owenia collaris</i>	54	11	8	19	92	25.84	230.0
AN <i>Mediomastus acutus</i>	5	16	10	13	44	12.36	110.0
AR <i>Diastylopsis tenuis</i>	10	7	3	6	26	7.30	65.0
AN <i>Apoprionospio pygmaea</i>	4	6	6	8	24	6.74	60.0
AN <i>Neosabellaria cementarium</i>	-	23	1	-	24	6.74	60.0
AN <i>Goniada littorea</i>	3	4	1	4	12	3.37	30.0
AN <i>Mediomastus</i> spp	2	2	3	3	10	2.81	25.0
MO <i>Crepidula norrisiarum</i>	-	7	2	-	9	2.53	22.5
AR <i>Rhepoxynius menziesi</i>	1	4	3	-	8	2.25	20.0
AR <i>Pyromiaia tuberculata</i>	3	3	-	1	7	1.97	17.5
AN <i>Spiochaetopterus costarum</i>	-	1	2	3	6	1.69	15.0
AN <i>Armandia brevis</i>	2	1	-	2	5	1.40	12.5
AN <i>Spiophanes bombyx</i>	2	1	2	-	5	1.40	12.5
AN <i>Nephrys caecoides</i>	-	3	1	-	4	1.12	10.0
AR <i>Aroides intermedius</i>	-	1	3	-	4	1.12	10.0
AR <i>Euphilomedes carcharodonta</i>	-	4	-	-	4	1.12	10.0
AR <i>Monocorophium acherusicum</i>	1	3	-	-	4	1.12	10.0
PR <i>Phoronopsis</i> sp	-	-	1	3	4	1.12	10.0
AN <i>Nephys cornuta</i>	-	2	1	-	3	0.84	7.5
AR <i>Photis brevipes</i>	-	1	2	-	3	0.84	7.5
CN <i>Hydractinia</i> sp	1	1	-	1	3	0.84	7.5
CN <i>Zaolatus actius</i>	1	1	1	-	3	0.84	7.5
MO <i>Cyclostremella dalli</i>	1	-	1	1	3	0.84	7.5
MO <i>Tellina modesta</i>	-	1	2	-	3	0.84	7.5
AN <i>Ampharete labrops</i>	1	-	-	1	2	0.56	5.0
AN <i>Aricidea (Acmira) catherinae</i>	-	1	1	-	2	0.56	5.0
AN <i>Diopatra tridentata</i>	-	2	-	-	2	0.56	5.0
AN <i>Euclymeninae</i>	-	1	1	-	2	0.56	5.0
AN <i>Eumida longicornuta</i>	1	1	-	-	2	0.56	5.0
AN <i>Glycinde armigera</i>	1	-	-	1	2	0.56	5.0
AN <i>Leitoscoloplos pugettensis</i>	1	1	-	-	2	0.56	5.0
AN <i>Scoletoma</i> sp B (Harris 1985)	-	1	1	-	2	0.56	5.0
AR <i>Neotrypaea californiensis</i>	1	-	1	-	2	0.56	5.0
MO <i>Kurtziella plumbea</i>	-	-	-	2	2	0.56	5.0
MO <i>Leptopecten latiauratus</i>	1	1	-	-	2	0.56	5.0
AN <i>Arabella semimaculata</i>	-	1	-	-	1	0.28	2.5
AN <i>Chaetozone setosa</i> Cmplx	1	-	-	-	1	0.28	2.5
AN <i>Chone</i> sp SD1 Pt. Loma 1997	-	-	-	1	1	0.28	2.5
AN <i>Monticellina cryptica</i>	1	-	-	-	1	0.28	2.5
AN <i>Parapriionospio pinnata</i>	1	-	-	-	1	0.28	2.5
AN <i>Scoletoma tetraura</i> Cmplx	-	-	1	-	1	0.28	2.5
AN <i>Sthenelais veruculosa</i>	1	-	-	-	1	0.28	2.5
AN <i>Syllis (Typosyllis) aciculata</i>	1	-	-	-	1	0.28	2.5
AR <i>Americhelidium shoemakeri</i>	1	-	-	-	1	0.28	2.5
AR <i>Argissa hamatipes</i>	1	-	-	-	1	0.28	2.5
AR <i>Balanus pacificus</i>	-	1	-	-	1	0.28	2.5
AR <i>Gibberosus myersi</i>	-	1	-	-	1	0.28	2.5
AR <i>Ogyrides</i> sp A Roney 1978	-	-	-	1	1	0.28	2.5
AR <i>Parasterope hulingsi</i>	-	-	1	-	1	0.28	2.5
AR <i>Photis bifurcata</i>	-	-	1	-	1	0.28	2.5
AR <i>Rhepoxynius stenodes</i>	1	-	-	-	1	0.28	2.5
AR <i>Rutiderma rostratum</i>	1	-	-	-	1	0.28	2.5
EC <i>Amphiuridae</i>	-	-	-	1	1	0.28	2.5
EP <i>Cryptarchnidium argilla</i>	-	1	-	-	1	0.28	2.5
MO <i>Cooperella subdiaphana</i>	-	1	-	-	1	0.28	2.5
MO <i>Macoma</i> sp	-	-	-	1	1	0.28	2.5
MO <i>Modiolus</i> sp	-	1	-	-	1	0.28	2.5
NE <i>Carinoma mutabilis</i>	-	-	1	-	1	0.28	2.5
NE <i>Lineidae</i>	-	-	1	-	1	0.28	2.5

Summary

Parameter	Replicate				Station	Replicate	
	B5-I	B5-II	B5-III	B5-IV		Mean	S.D.
Number of individuals	105	117	62	72	356	89.0	26.2
Number of species	29	35	28	19	59	27.8	6.6
Diversity (H')	2.15	2.95	2.99	2.40	3.03	2.62	0.41

Appendix G-3. (Cont.).

Station B6

Phylum	Species	Replicate				Total	Percent Composition	Density No./m ²
		B6-I	B6-II	B6-III	B6-IV			
AN	<i>Owenia collaris</i>	26	10	25	16	77	27.90	192.5
AN	<i>Mediomastus acutus</i>	7	6	12	13	38	13.77	95.0
AN	<i>Apopionospio pygmaea</i>	6	2	7	9	24	8.70	60.0
AR	<i>Diastylopsis tenuis</i>	5	5	2	7	19	6.88	47.5
AN	<i>Nephtys caecoides</i>	1	2	5	3	11	3.99	27.5
AR	<i>Rhepoxyrinus menziesi</i>	1	4	1	1	7	2.54	17.5
AR	<i>Americhelidium shoemakeri</i>	-	2	-	4	6	2.17	15.0
MO	<i>Cyclostremella dalli</i>	-	3	2	1	6	2.17	15.0
MO	<i>Tellina modesta</i>	-	2	2	2	6	2.17	15.0
AR	<i>Euphilomedes longiseta</i>	2	3	-	-	5	1.81	12.5
AR	<i>Photis brevipes</i>	-	-	1	4	5	1.81	12.5
AR	<i>Pyromaria tuberculata</i>	1	4	-	-	5	1.81	12.5
AN	<i>Pectinaria californiensis</i>	-	1	1	2	4	1.45	10.0
AR	<i>Gibberosus myersi</i>	1	-	1	2	4	1.45	10.0
AR	<i>Hartmanodes hartmanae</i>	-	-	-	4	4	1.45	10.0
MO	<i>Crepidula</i> sp	1	3	-	-	4	1.45	10.0
MO	<i>Olivella baetica</i>	1	-	1	2	4	1.45	10.0
PR	<i>Phorona</i>	-	1	2	1	4	1.45	10.0
AN	<i>Cirriformia moorei</i>	-	1	1	1	3	1.09	7.5
AN	<i>Goniada littorea</i>	-	2	-	1	3	1.09	7.5
AN	<i>Mediomastus</i> spp	1	-	1	1	3	1.09	7.5
AR	<i>Monocorophium acherusicum</i>	1	1	1	-	3	1.09	7.5
AN	<i>Eumida longicornuta</i>	1	-	1	-	2	0.72	5.0
AN	<i>Spiophanes duplex</i>	-	-	1	1	2	0.72	5.0
AR	<i>Argissa hamatipes</i>	2	-	-	-	2	0.72	5.0
CN	<i>Zaolatus actius</i>	-	-	2	-	2	0.72	5.0
NE	Lineidae	-	-	-	2	2	0.72	5.0
NE	<i>Tubulanus polymorphus</i>	-	1	-	1	2	0.72	5.0
AN	<i>Armandia brevis</i>	-	-	-	1	1	0.36	2.5
AN	<i>Carazziaella</i> sp A SCAMIT 1995	1	-	-	-	1	0.36	2.5
AN	<i>Cirriformia</i> sp	1	-	-	-	1	0.36	2.5
AN	<i>Diopatra tridentata</i>	-	1	-	-	1	0.36	2.5
AN	<i>Glycera macrobrachia</i>	1	-	-	-	1	0.36	2.5
AN	<i>Leitoscoloplos pugentensis</i>	-	-	1	-	1	0.36	2.5
AN	<i>Neosabellaria cementarium</i>	1	-	-	-	1	0.36	2.5
AN	<i>Nephtys cornuta</i>	-	1	-	-	1	0.36	2.5
AN	<i>Pista disjuncta</i>	-	-	-	1	1	0.36	2.5
AR	Brachyura (megalopa)	-	-	1	-	1	0.36	2.5
AR	<i>Ericthonius brasiliensis</i>	-	-	1	-	1	0.36	2.5
AR	<i>Leptostylis calva</i>	-	-	1	-	1	0.36	2.5
AR	<i>Parasterope hulingsi</i>	-	-	-	1	1	0.36	2.5
AR	<i>Uromunna ubiquita</i>	1	-	-	-	1	0.36	2.5
CN	Actiniaria	1	-	-	-	1	0.36	2.5
CO	<i>Enteropneusta</i>	1	-	-	-	1	0.36	2.5
MO	<i>Turbonilla santarosana</i>	-	-	1	-	1	0.36	2.5
NE	<i>Carinoma mutabilis</i>	-	1	-	-	1	0.36	2.5
NE	<i>Paranemertes californica</i>	-	1	-	-	1	0.36	2.5

Summary

Parameter	Replicate				Station Total	Replicate	
	B6-I	B6-II	B6-III	B6-IV		Mean	S.D.
Number of individuals	64	57	74	81	276	69.0	10.6
Number of species	22	22	24	24	47	23.0	1.2
Diversity (H')	2.29	2.82	2.43	2.69	2.88	2.56	0.24

Appendix G-3. (Cont.).

Station B7

Phylum	Species	Replicate				Total	Percent Composition	Density No./m ²
		B7-I	B7-II	B7-III	B7-IV			
AN	<i>Cossura</i> sp A Phillips 1987	15	30	28	28	101	28.29	252.5
AN	<i>Mediomastus</i> spp	2	3	16	2	23	6.44	57.5
AR	<i>Amphideutopus oculatus</i>	3	2	10	8	23	6.44	57.5
AN	<i>Aphelochaeta monilaris</i>	5	5	3	5	18	5.04	45.0
AN	<i>Monticellina cryptica</i>	1	4	6	3	14	3.92	35.0
AN	<i>Aphelochaeta glandaria</i>	4	2	3	1	10	2.80	25.0
AN	<i>Scoletoma</i> sp	-	3	3	3	9	2.52	22.5
AR	<i>Leptostylis calva</i>	1	1	5	2	9	2.52	22.5
AN	<i>Euclymeninæ</i> sp A SCAMIT 1987	2	-	5	1	8	2.24	20.0
AN	<i>Nephrys cornuta</i>	3	1	3	1	8	2.24	20.0
AN	<i>Nereis procera</i>	1	3	3	1	8	2.24	20.0
AN	<i>Notomastus</i> sp A SCAMIT 2001	1	4	2	1	8	2.24	20.0
AN	<i>Podarkeopsis</i> sp A Harris & Velarde 1983	-	1	4	1	6	1.68	15.0
AN	<i>Laonice cirrata</i>	-	-	3	2	5	1.40	12.5
AN	<i>Leitoscoloplos pugettensis</i>	-	1	1	3	5	1.40	12.5
AN	<i>Terebellides californica</i>	1	3	-	1	5	1.40	12.5
AR	Gammaridea	3	1	-	1	5	1.40	12.5
MO	<i>Cadulus aberrans</i>	1	2	1	1	5	1.40	12.5
AN	<i>Aricidea (Acmira) horikoshii</i>	-	1	1	2	4	1.12	10.0
AN	<i>Chaetozone corona</i>	3	-	-	1	4	1.12	10.0
AN	<i>Melinna oculata</i>	2	-	1	1	4	1.12	10.0
MO	<i>Nuculana tephria</i>	-	1	1	2	4	1.12	10.0
AN	<i>Glycera americana</i>	-	2	1	-	3	0.84	7.5
AN	<i>Parapriionospio pinnata</i>	1	1	1	-	3	0.84	7.5
AR	<i>Euphilomedes carcharodonta</i>	-	-	1	2	3	0.84	7.5
NE	<i>Tubulanus polymorphus</i>	-	1	1	1	3	0.84	7.5
AN	<i>Amphicteis scaphobranchiata</i>	-	-	1	1	2	0.56	5.0
AN	<i>Aricidea (Acmira) catherinae</i>	2	-	-	-	2	0.56	5.0
AN	<i>Podarkeopsis glabra</i>	1	-	-	1	2	0.56	5.0
AN	<i>Prionospio (Minuspio) lighti</i>	-	-	2	-	2	0.56	5.0
AN	<i>Sigambla setosa</i>	2	-	-	-	2	0.56	5.0
AN	Terebellidae	-	2	-	-	2	0.56	5.0
MO	<i>Modiolus</i> sp	1	-	-	1	2	0.56	5.0
MO	<i>Periploma discus</i>	1	-	-	1	2	0.56	5.0
PR	Phorona	-	1	1	-	2	0.56	5.0
AN	<i>Apopriionospio pygmaea</i>	-	1	-	-	1	0.28	2.5
AN	<i>Chone mollis</i>	-	-	1	-	1	0.28	2.5
AN	<i>Driotonereis longa</i>	-	1	-	-	1	0.28	2.5
AN	<i>Euchone incolor</i>	-	-	-	1	1	0.28	2.5
AN	<i>Euchone limnicola</i>	-	-	1	-	1	0.28	2.5
AN	Lumbrineridae	1	-	-	-	1	0.28	2.5
AN	<i>Lumbrineris</i> sp	-	1	-	-	1	0.28	2.5
AN	<i>Malmgreniella macginitieei</i>	-	1	-	-	1	0.28	2.5
AN	<i>Marphyssæ</i> sp A Harris & Velarde 1983	-	1	-	-	1	0.28	2.5
AN	<i>Mediomastus acutus</i>	1	-	-	-	1	0.28	2.5
AN	Onuphidae	1	-	-	-	1	0.28	2.5
AN	<i>Pectinaria californiensis</i>	-	-	1	-	1	0.28	2.5
AN	<i>Pholos glabra</i>	-	-	1	-	1	0.28	2.5
AN	<i>Pista agassizi</i>	1	-	-	-	1	0.28	2.5
AN	<i>Pista disjuncta</i>	1	-	-	-	1	0.28	2.5
AN	<i>Praxillella pacifica</i>	-	1	-	-	1	0.28	2.5
AN	<i>Scalibregma californicum</i>	1	-	-	-	1	0.28	2.5
AN	<i>Scoletoma tetraura</i> Cmplx	1	-	-	-	1	0.28	2.5
AN	<i>Spiophanes duplex</i>	-	1	-	-	1	0.28	2.5
AN	<i>Streblosoma crassibranchia</i>	1	-	-	-	1	0.28	2.5
AR	<i>Argissa hamatipes</i>	-	-	1	-	1	0.28	2.5
AR	<i>Caeocnathia crenulatifrons</i>	-	-	-	1	1	0.28	2.5
AR	<i>Edotia sublittoralis</i>	1	-	-	-	1	0.28	2.5
AR	Harpacticoida	-	-	1	-	1	0.28	2.5
AR	<i>Leuroleberis sharpei</i>	-	-	1	-	1	0.28	2.5
AR	<i>Photis brevipes</i>	-	-	-	1	1	0.28	2.5
AR	<i>Rudilemboides stenopropodus</i>	-	-	1	-	1	0.28	2.5
AR	<i>Rutiderma rostratum</i>	1	-	-	-	1	0.28	2.5
BC	<i>Glottidia albida</i>	-	-	1	-	1	0.28	2.5
CN	<i>Edwardsia</i> sp G MEC 1992	1	-	-	-	1	0.28	2.5
EC	<i>Amphiodia digitata</i>	-	-	1	-	1	0.28	2.5
EC	<i>Amphiodia psara</i>	-	-	1	-	1	0.28	2.5
EC	<i>Amphiodia</i> sp	-	-	-	1	1	0.28	2.5
MO	<i>Actaecina culicella</i>	1	-	-	-	1	0.28	2.5
MO	<i>Philine</i> sp A SCAMIT 1988	-	-	-	1	1	0.28	2.5

Appendix G-3. (Cont.).

Station B7

Phylum Species	Replicate				Total	Percent Composition	Density No./m ²
	B7-I	B7-II	B7-III	B7-IV			
MO <i>Philine auriformis</i>	1	-	-	-	1	0.28	2.5
MO <i>Rocheffortia tumida</i>	1	-	-	-	1	0.28	2.5
MO <i>Theora lubrica</i>	-	-	1	-	1	0.28	2.5
MO <i>Thyasira flexuosa</i>	1	-	-	-	1	0.28	2.5
MO <i>Trachycardium quadragenarium</i>	-	1	-	-	1	0.28	2.5
PR <i>Phoronis</i> sp	1	-	-	-	1	0.28	2.5

Summary

Parameter	Replicate				Station Total	Replicate	
	B7-I	B7-II	B7-III	B7-IV		Mean	S.D.
Number of individuals	72	83	119	83	357	89.3	20.5
Number of species	38	31	38	33	76	35.0	3.6
Diversity (H')	3.24	2.72	2.97	2.78	3.28	2.93	0.24

Appendix G-3. (Cont.).

Station B8

Phylum	Species	Replicate				Total	Percent Composition	Density No./m ²
		B8-I	B8-II	B8-III	B8-IV			
AN	<i>Spiophanes bombyx</i>	6	15	3	4	28	12.73	70.0
AN	<i>Mediomastus</i> spp	6	6	6	1	19	8.64	47.5
AN	<i>Apopriionospio pygmaea</i>	6	2	4	4	16	7.27	40.0
AN	<i>Glycera branchiopoda</i>	2	5	2	5	14	6.36	35.0
AN	<i>Mediomastus acutus</i>	5	2	4	2	13	5.91	32.5
AN	<i>Spiophanes duplex</i>	1	8	2	2	13	5.91	32.5
AN	<i>Euchone incolor</i>	2	5	2	2	11	5.00	27.5
CN	<i>Edwardsia</i> sp G MEC 1992	4	4	-	-	8	3.64	20.0
AN	<i>Amaeana occidentalis</i>	-	1	4	2	7	3.18	17.5
PR	<i>Phorona</i>	1	4	1	-	6	2.73	15.0
AR	<i>Hemilamprops californica</i>	-	1	1	2	4	1.82	10.0
NE	<i>Tubulanus polymorphus</i>	-	1	2	1	4	1.82	10.0
AN	<i>Nereis procerata</i>	1	1	-	1	3	1.36	7.5
AN	<i>Owenia collaris</i>	1	1	-	1	3	1.36	7.5
AN	<i>Phyllocoete hartmanae</i>	-	-	1	2	3	1.36	7.5
AN	<i>Scalibregma californicum</i>	1	2	-	-	3	1.36	7.5
AR	<i>Rutiderma rostratum</i>	1	2	-	-	3	1.36	7.5
MO	<i>Tellina modesta</i>	-	2	1	-	3	1.36	7.5
AN	<i>Chaetozone setosa</i> Cmpx	-	-	1	1	2	0.91	5.0
AN	<i>Dorvillea</i> sp	2	-	-	-	2	0.91	5.0
AN	<i>Exogone lourei</i>	-	1	1	-	2	0.91	5.0
AN	<i>Malmgreniella macginittiei</i>	-	-	1	1	2	0.91	5.0
AN	<i>Nephtys cornuta</i>	1	-	-	1	2	0.91	5.0
AN	<i>Polydorea cornuta</i>	-	1	1	-	2	0.91	5.0
AN	<i>Sigalion spinosus</i>	-	-	-	2	2	0.91	5.0
AR	<i>Rudilemboides stenopropodus</i>	-	-	1	1	2	0.91	5.0
CO	<i>Agnezia septentrionalis</i>	1	-	1	-	2	0.91	5.0
MO	<i>Macoma yoldiformis</i>	-	-	2	-	2	0.91	5.0
NE	<i>Monostylifera</i> sp SD1 Pt. Loma 1995	1	1	-	-	2	0.91	5.0
NT	Nematoda	1	-	1	-	2	0.91	5.0
AN	<i>Arcteobia cf anticostiensis</i>	-	-	-	1	1	0.45	2.5
AN	<i>Arcidea (Acmira) catherinae</i>	-	-	-	1	1	0.45	2.5
AN	<i>Arcidea (Aricidea) wassi</i>	1	-	-	-	1	0.45	2.5
AN	<i>Cossura</i> sp A Phillips 1987	-	1	-	-	1	0.45	2.5
AN	Euclymeninae	-	-	-	1	1	0.45	2.5
AN	<i>Glycinde armigera</i>	1	-	-	-	1	0.45	2.5
AN	<i>Hesioneilla mccullochae</i>	-	1	-	-	1	0.45	2.5
AN	<i>Magelona sacculata</i>	1	-	-	-	1	0.45	2.5
AN	<i>Monticellina cryptica</i>	1	-	-	-	1	0.45	2.5
AN	Oligochaeta	1	-	-	-	1	0.45	2.5
AN	<i>Parapriionospio pinnata</i>	-	1	-	-	1	0.45	2.5
AN	<i>Phyllodocidae</i>	-	1	-	-	1	0.45	2.5
AN	<i>Pista disjuncta</i>	1	-	-	-	1	0.45	2.5
AN	<i>Scopeloma</i> sp B (Harris 1985)	1	-	-	-	1	0.45	2.5
AN	<i>Scoloplos armiger</i> Cmpx	1	-	-	-	1	0.45	2.5
AN	<i>Spiochaetopterus costarum</i>	-	1	-	-	1	0.45	2.5
AN	<i>Syllis (Typosyllis) aciculata</i>	-	-	1	-	1	0.45	2.5
AR	<i>Americichelidium shoemakeri</i>	-	-	-	1	1	0.45	2.5
AR	<i>Amphideutopus oculatus</i>	-	-	1	-	1	0.45	2.5
AR	<i>Cyclaspis</i> sp SCAMIT 1986	-	-	-	1	1	0.45	2.5
AR	<i>Foxiphalus obtusidens</i>	-	-	1	-	1	0.45	2.5
AR	Harpacticoida	-	1	-	-	1	0.45	2.5
AR	<i>Monocorophium acherusicum</i>	1	-	-	-	1	0.45	2.5
AR	<i>Parasterope hulingsi</i>	1	-	-	-	1	0.45	2.5
AR	<i>Photis</i> sp OC1 Diener 1992	-	-	-	1	1	0.45	2.5
AR	<i>Rhepoxynius menziesi</i>	1	-	-	-	1	0.45	2.5
AR	<i>Uromunna ubiquita</i>	1	-	-	-	1	0.45	2.5
CN	<i>Stylatula elongata</i>	1	-	-	-	1	0.45	2.5
EC	<i>Amphiodia digitata</i>	-	1	-	-	1	0.45	2.5
MO	<i>Modiolus</i> sp	-	-	-	1	1	0.45	2.5
MO	<i>Olivella baetica</i>	-	-	-	1	1	0.45	2.5
MO	<i>Rochefortia coanni</i>	-	-	1	-	1	0.45	2.5
NE	<i>Carinoma mutabilis</i>	1	-	-	-	1	0.45	2.5
PL	<i>Eurylepta</i> sp	1	-	-	-	1	0.45	2.5

Summary

Parameter	Replicate				Station Total	Replicate	
	B8-I	B8-II	B8-III	B8-IV		Mean	S.D.
Number of individuals	58	72	47	43	220	55.0	13.0
Number of species	33	27	26	26	65	28.0	3.4
Diversity (H')	2.96	2.53	2.87	2.87	3.52	2.81	0.19

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Appendix G-3. (Cont.).

Station B9

Phylum	Species	Replicate				Total	Percent	Density
		B9-I	B9-II	B9-III	B9-IV			
AN	<i>Mediomastus</i> spp	12	8	19	3	42	16.34	105.0
AN	<i>Scoletoma</i> sp	5	1	7	5	18	7.00	45.0
AN	<i>Apoprionospio pygmaea</i>	4	1	6	6	17	6.61	42.5
AN	<i>Monticellina cryptica</i>	5	3	6	1	15	5.84	37.5
AR	<i>Euphilomedes carcharodonta</i>	-	2	6	2	10	3.89	25.0
AN	<i>Mediomastus acutus</i>	5	-	2	1	8	3.11	20.0
AN	<i>Nereis procula</i>	1	2	3	2	8	3.11	20.0
AN	<i>Prionospio (Miruspis) lighti</i>	2	-	6	-	8	3.11	20.0
AN	<i>Amaeana occidentalis</i>	2	1	2	1	6	2.33	15.0
AN	<i>Chaetozone setosa</i> Cmplx	2	-	3	1	6	2.33	15.0
AN	<i>Euchone incolor</i>	3	-	2	1	6	2.33	15.0
AN	<i>Glycinde armigera</i>	2	2	1	1	6	2.33	15.0
AN	<i>Parapriionospio pinnata</i>	3	1	1	1	6	2.33	15.0
CN	<i>Edwardsia</i> sp G MEC 1992	1	-	3	2	6	2.33	15.0
AN	<i>Aricidea (Acmira) catherinae</i>	1	2	-	1	4	1.56	10.0
AN	<i>Euclymeninae</i>	1	2	1	-	4	1.56	10.0
AR	<i>Rutiderma rostratum</i>	-	2	2	-	4	1.56	10.0
AN	<i>Amphicteis scaphobranchiata</i>	1	-	1	1	3	1.17	7.5
AN	<i>Goniada littorea</i>	-	-	1	2	3	1.17	7.5
AN	<i>Levinsenia gracilis</i>	-	1	2	-	3	1.17	7.5
AN	<i>Pista disjuncta</i>	-	2	1	-	3	1.17	7.5
AN	<i>Scoletoma tetraura</i> Cmplx	2	1	-	-	3	1.17	7.5
AN	<i>Spiochaetopterus costorum</i>	1	1	1	-	3	1.17	7.5
MO	<i>Odostomia</i> sp D MBC 1980	-	1	1	1	3	1.17	7.5
NE	<i>Paranemertes californica</i>	2	1	-	-	3	1.17	7.5
NE	<i>Tubulanus polymorphus</i>	-	2	1	-	3	1.17	7.5
AN	<i>Aphelochaeta glandaria</i>	-	1	-	1	2	0.78	5.0
AN	<i>Arabella semimaculata</i>	-	-	1	1	2	0.78	5.0
AN	<i>Aricidea (Aricidea) wassi</i>	1	-	1	-	2	0.78	5.0
AN	<i>Eteone pigmentata</i>	-	-	2	-	2	0.78	5.0
AN	<i>Goniada maculata</i>	-	1	-	1	2	0.78	5.0
AN	<i>Malmgreniella macginittie</i>	-	1	1	-	2	0.78	5.0
AN	<i>Spiophanes duplex</i>	-	1	1	-	2	0.78	5.0
AN	<i>Sthenelais tertiaiglabra</i>	-	-	2	-	2	0.78	5.0
AR	<i>Amphideutopus oculatus</i>	2	-	-	-	2	0.78	5.0
AR	<i>Argissa hamatipes</i>	1	1	-	-	2	0.78	5.0
AR	<i>Listriella goleta</i>	-	2	-	-	2	0.78	5.0
AR	<i>Pinnixa franciscana</i>	1	1	-	-	2	0.78	5.0
MO	<i>Macoma yoldiformis</i>	1	1	-	-	2	0.78	5.0
MO	<i>Tellina modesta</i>	-	-	1	1	2	0.78	5.0
NT	Nematoda	-	1	1	-	2	0.78	5.0
PR	<i>Phoronis</i> sp	-	-	2	-	2	0.78	5.0
AN	<i>Aricidea (Acmira) horikoshii</i>	-	-	1	-	1	0.39	2.5
AN	<i>Cossura</i> sp A Phillips 1987	-	1	-	-	1	0.39	2.5
AN	<i>Eumida longicornuta</i>	-	-	1	-	1	0.39	2.5
AN	<i>Leonice cirrata</i>	-	1	-	-	1	0.39	2.5
AN	<i>Onuphis</i> sp 1 Pt Loma 1983	1	-	-	-	1	0.39	2.5
AN	<i>Poecilochaetus johnsoni</i>	-	-	1	-	1	0.39	2.5
AN	<i>Polycirrus</i> sp A SCAMIT 1995	-	-	1	-	1	0.39	2.5
AN	<i>Polydora cornuta</i>	-	-	1	-	1	0.39	2.5
AN	<i>Spiophanes berkeleyorum</i>	-	1	-	-	1	0.39	2.5
AN	<i>Tenonia priops</i>	-	1	-	-	1	0.39	2.5
AR	<i>Ampelisca brevisimulata</i>	-	-	-	1	1	0.39	2.5
AR	<i>Edotia sublittoralis</i>	-	1	-	-	1	0.39	2.5
AR	<i>Parasterope hulingsi</i>	-	1	-	-	1	0.39	2.5
BC	<i>Glottidia albida</i>	-	-	-	1	1	0.39	2.5
CO	Enteropneusta	-	1	-	-	1	0.39	2.5
MO	<i>Acteocina harpa</i>	-	-	-	1	1	0.39	2.5
MO	<i>Cooperella subdiaphana</i>	1	-	-	-	1	0.39	2.5
MO	<i>Olivella baetica</i>	1	-	-	-	1	0.39	2.5
MO	<i>Rocheftoria coani</i>	-	-	-	1	1	0.39	2.5
MO	<i>Rocheftoria grippi</i>	-	1	-	-	1	0.39	2.5
NE	<i>Amphiporus bimaculatus</i>	-	1	-	-	1	0.39	2.5
NE	<i>Carinoma mutabilis</i>	-	-	1	-	1	0.39	2.5
NE	<i>Hoplонемерта</i> sp B MEC 1988	-	-	1	-	1	0.39	2.5
NE	<i>Tetrastemma</i> sp A SCAMIT 1995	1	-	-	-	1	0.39	2.5

Summary

Parameter	Replicate				Station	Replicate		
	B9-I	B9-II	B9-III	B9-IV		Total	Mean	S.D.
Number of individuals	65	55	97	40	257	64.3	24.1	
Number of species	28	37	39	25	66	32.3	6.8	
Diversity (H')	2.50	3.06	2.69	2.54	3.59	2.70	0.26	

Appendix G-3. (Cont.).

Station B10

Phylum	Species	Replicate				Total	Percent Composition	Density No./m ²
		B10-I	B10-II	B10-III	B10-IV			
AN	<i>Streblospio benedicti</i>	66	110	158	46	380	75.55	950.0
AR	<i>Grandidierella japonica</i>	3	34	40	17	94	18.69	235.0
AN	<i>Polydora cirrosa</i>	6	-	5	1	12	2.39	30.0
AR	<i>Monocorophium acherusicum</i>	-	2	3	2	7	1.39	17.5
AN	<i>Capitella capitata</i> Cmplx	-	5	-	1	6	1.19	15.0
AN	<i>Nephtys cornuta</i>	-	1	-	-	1	0.20	2.5
AN	Oligochaeta	1	-	-	-	1	0.20	2.5
AN	<i>Polydora cornuta</i>	1	-	-	-	1	0.20	2.5
MO	<i>Tagelus subteres</i>	-	-	1	-	1	0.20	2.5

Summary

Parameter	Replicate				Station Total	Replicate	
	B10-I	B10-II	B10-III	B10-IV		Mean	S.D.
Number of individuals	77	152	207	67	503	125.8	66.1
Number of species	5	5	5	5	9	5.0	0.0
Diversity (H')	0.31	0.20	0.18	0.23	0.78	0.23	0.06

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Appendix G-3. (Cont.).

Station B11

Phylum	Species	Replicate				Total	Percent Composition	Density No./m ²
		B11-I	B11-II	B11-III	B11-IV			
AR	<i>Monocorophium acherusicum</i>	2016	1735	1400	1954	7105	75.67	17762.5
AR	<i>Ericthonius brasiliensis</i>	152	372	408	281	1213	12.92	3032.5
AR	<i>Grandidierella japonica</i>	100	52	99	63	314	3.34	785.0
AN	<i>Streblosoma</i> sp B SCAMIT 1985	19	20	10	66	115	1.22	287.5
AN	<i>Capitella capitata</i> Cmplx	17	36	9	24	86	0.92	215.0
AR	<i>Elasmopus bampo</i>	15	38	11	19	83	0.88	207.5
AN	<i>Sphaerosyllis californiensis</i>	14	32	11	15	72	0.77	180.0
AN	<i>Cirriformia</i> sp	22	12	12	16	62	0.66	155.0
AR	<i>Paranthura elegans</i>	7	17	6	29	59	0.63	147.5
MO	<i>Barleeia subtenuis</i>	9	7	3	23	42	0.45	105.0
PL	<i>Notoplane</i> sp	8	4	12	15	39	0.42	97.5
AN	<i>Spiro filicornis</i>	12	7	11	5	35	0.37	87.5
AR	<i>Paracerceis sculpta</i>	4	5	13	2	24	0.26	60.0
AN	<i>Neanthes acuminata</i> Cmplx	5	10	3	4	22	0.23	55.0
AR	<i>Podocerus fulanus</i>	4	7	5	3	19	0.20	47.5
AR	<i>Anoplodactylus viridintestinalis</i>	7	-	3	8	18	0.19	45.0
AN	<i>Dipolydora socialis</i>	2	3	1	4	10	0.11	25.0
AN	<i>Streblospio benedicti</i>	3	1	2	4	10	0.11	25.0
AN	<i>Ophryotrocha</i> sp	1	2	1	3	7	0.07	17.5
AN	<i>Oligochaeta</i>	4	1	-	-	5	0.05	12.5
CN	<i>Epiactis prolifera</i>	3	2	-	-	5	0.05	12.5
AN	<i>Dipolydora giardi</i>	1	3	-	-	4	0.04	10.0
AN	<i>Syllis (Syllis) gracilis</i>	-	1	1	2	4	0.04	10.0
CN	<i>Actinaria</i>	2	1	1	-	4	0.04	10.0
AR	<i>Zeuxo normani</i>	-	2	-	1	3	0.03	7.5
MO	<i>Hiatella arctica</i>	1	2	-	-	3	0.03	7.5
NE	<i>Nemertea</i>	-	1	1	1	3	0.03	7.5
AN	<i>Lumbrineridae</i>	-	1	-	1	2	0.02	5.0
AR	<i>Ampithoidae</i>	-	-	-	2	2	0.02	5.0
AR	<i>Postasterope barnesi</i>	1	1	-	-	2	0.02	5.0
AN	<i>Annelida</i>	-	-	-	1	1	0.01	2.5
AN	<i>Autolytinae</i>	-	-	-	1	1	0.01	2.5
AN	<i>Eupolynnia heterobranchia</i>	-	-	1	-	1	0.01	2.5
AN	<i>Halosydna johnsoni</i>	-	-	-	1	1	0.01	2.5
AN	<i>Marpissa</i> sp A Harris & Velarde 1983	-	1	-	-	1	0.01	2.5
AN	<i>Monticellina cryptica</i>	-	-	-	1	1	0.01	2.5
AN	<i>Polydora cornuta</i>	-	-	1	-	1	0.01	2.5
AN	<i>Polyopthalmus pictus</i>	-	1	-	-	1	0.01	2.5
AN	<i>Trypanosyllis</i> sp	-	1	-	-	1	0.01	2.5
AR	<i>Ammothaea hilgendorfi</i>	-	-	1	-	1	0.01	2.5
AR	<i>Brachyura</i>	1	-	-	-	1	0.01	2.5
AR	<i>Caprella</i> sp	-	-	-	1	1	0.01	2.5
MO	<i>Crucibulum spinosum</i>	-	1	-	-	1	0.01	2.5
MO	<i>Petricola carditoides</i>	-	1	-	-	1	0.01	2.5
NE	<i>Lineidae</i>	-	-	-	1	1	0.01	2.5
NE	<i>Paranemertes californica</i>	-	1	-	-	1	0.01	2.5
NE	<i>Zygonemertes virescens</i>	-	-	-	1	1	0.01	2.5

Summary

Parameter	Replicate				Station Total	Replicate	
	B11-I	B11-II	B11-III	B11-IV		Mean	S.D.
Number of individuals	2430	2381	2026	2552	9389	2347.3	225.9
Number of species	26	34	25	31	47	29.0	4.2
Diversity (H')	0.50	0.55	0.47	0.58	1.02	0.52	0.05

Appendix G-3. (Cont.).

Station B12

Phylum Species	Replicate				Total	Percent Composition	Density No./m ²
	B12-I	B12-II	B12-III	B12-IV			
AR <i>Monocorophium acherusicum</i>	2388	2095	2296	2467	9246	73.74	23115.0
AR <i>Ericthonius brasiliensis</i>	482	310	383	412	1587	12.66	3967.5
AR <i>Grandidierella japonica</i>	137	110	154	122	523	4.17	1307.5
AN <i>Streblospio benedicti</i>	51	41	90	58	240	1.91	600.0
AN <i>Streblosoma</i> sp B SCAMIT 1985	48	59	47	56	210	1.67	525.0
CN <i>Actiniaria</i>	41	26	44	20	131	1.04	327.5
AR <i>Elasmopus bampo</i>	34	36	24	36	130	1.04	325.0
AN <i>Capitella capitata</i> CMPLX	24	17	64	24	129	1.03	322.5
AN <i>Cirriformia</i> sp	9	10	77	11	107	0.85	267.5
AN <i>Sphaerosyllis californiensis</i>	5	13	15	15	48	0.38	120.0
AR <i>Podocerus fulanus</i>	5	20	9	4	38	0.30	95.0
AR <i>Paracerceis sculpta</i>	8	6	9	14	37	0.30	92.5
MO <i>Tagelus</i> sp	1	2	9	4	16	0.13	40.0
AR <i>Parenthura elegans</i>	2	3	5	5	15	0.12	37.5
AN <i>Dipolydora socialis</i>	3	-	5	2	10	0.08	25.0
AN <i>Ophryotrocha</i> sp	2	2	1	4	9	0.07	22.5
AN <i>Neanthes acuminata</i> Cmplx	-	3	3	1	7	0.06	17.5
AN <i>Spio filicornis</i>	2	1	2	2	7	0.06	17.5
AR <i>Ampithoe valida</i>	1	6	-	-	7	0.06	17.5
AR <i>Caprella mendax</i>	-	4	2	1	7	0.06	17.5
MO <i>Barlecia subtenuis</i>	2	1	1	2	6	0.05	15.0
AN <i>Marphysa sanguinea</i>	-	1	1	2	4	0.03	10.0
MO <i>Hiatella arctica</i>	1	1	1	1	4	0.03	10.0
AN <i>Lumbrineridae</i>	2	-	-	-	2	0.02	5.0
MO <i>Leivicardium substratum</i>	1	-	1	-	2	0.02	5.0
AN <i>Pherusa capulata</i>	-	-	1	-	1	0.01	2.5
AN <i>Polydora cornuta</i>	1	-	-	-	1	0.01	2.5
AN <i>Polydora nuchalis</i>	-	-	-	1	1	0.01	2.5
AN <i>Polyopthalmus pictus</i>	-	-	1	-	1	0.01	2.5
AR <i>Ammothea hilgendorfi</i>	-	-	-	1	1	0.01	2.5
AR <i>Cytheridae</i>	-	-	1	-	1	0.01	2.5
AR <i>Zeuxo normani</i>	-	-	-	1	1	0.01	2.5
MO <i>Aplysiidae</i>	-	-	-	1	1	0.01	2.5
MO <i>Bivalvia</i>	-	1	-	-	1	0.01	2.5
MO <i>Haminoea virescens</i>	-	-	-	1	1	0.01	2.5
NE <i>Amphiporus</i> sp	-	-	1	-	1	0.01	2.5
NE <i>Nemertea</i>	-	1	-	-	1	0.01	2.5
NT <i>Nematoda</i>	-	-	1	-	1	0.01	2.5
PL <i>Notoplana</i> sp	-	1	-	-	1	0.01	2.5
PL <i>Pseudoceros</i> sp	-	1	-	-	1	0.01	2.5
PR <i>Phoronis</i> sp	-	-	1	-	1	0.01	2.5

Summary

Parameter	Replicate				Station Total	Replicate	
	B12-I	B12-II	B12-III	B12-IV		Mean	S.D.
Number of individuals	3250	2771	3249	3268	12538	3134.5	242.5
Number of species	23	26	29	27	41	26.3	2.5
Diversity (H')	0.49	0.57	0.70	0.52	1.07	0.57	0.09

**Appendix G-4. Infaunal wet weight biomass data (g). Haynes and AES Alamitos L.L.C.
generating stations NPDES, 2001.**

Sta-Rep	Annelida	Arthropoda	Mollusca	Echinodermata	Misc.	Total
B1-I	0.047	0.033	0.002	-	0.223	0.305
B1-II	0.626	0.007	0.045	-	0.299	0.977
B1-III	0.170	0.807	0.159	-	0.117	1.253
B1-IV	0.612	0.086	0.193	0.029	0.148	1.068
Total	1.455	0.933	0.399	0.029	0.787	3.603
B2-I	0.652	1.555	0.113	-	0.048	2.368
B2-II	1.734	0.074	0.053	<0.001	0.005	1.866
B2-III	2.077	0.001	0.093	-	0.081	2.252
B2-IV	1.782	0.107	0.037	-	0.355	2.281
Total	6.245	1.737	0.296	<0.001	0.489	8.767
B3-I	0.632	0.009	0.212	-	0.282	1.135
B3-II	0.727	0.003	0.002	0.032	-	0.764
B3-III	0.105	0.004	0.066	0.091	0.013	0.279
B3-IV	0.379	0.014	0.243	0.194	0.081	0.911
Total	1.843	0.030	0.523	0.317	0.376	3.089
B4-I	0.094	0.063	0.084	-	0.036	0.277
B4-II	0.248	0.016	0.013	-	0.015	0.292
B4-III	0.087	0.010	0.010	-	-	0.107
B4-IV	0.027	0.051	0.021	-	0.193	0.292
Total	0.456	0.140	0.128	-	0.244	0.968
B5-I	1.758	0.296	0.021	-	0.018	2.093
B5-II	1.423	0.713	0.316	-	0.010	2.462
B5-III	0.116	0.006	0.009	-	0.196	0.327
B5-IV	0.829	0.044	0.010	0.001	0.018	0.902
Total	4.126	1.059	0.356	0.001	0.242	5.784
B6-I	0.234	0.051	0.034	-	0.004	0.323
B6-II	2.162	0.168	0.141	-	0.038	2.509
B6-III	0.329	0.001	0.055	-	0.241	0.626
B6-IV	0.442	0.013	0.065	-	0.151	0.671
Total	3.167	0.233	0.295	-	0.434	4.129
B7-I	0.277	0.037	0.154	-	0.007	0.475
B7-II	0.385	0.027	0.025	-	0.021	0.458
B7-III	0.195	0.023	0.147	0.398	0.049	0.812
B7-IV	0.446	0.021	0.028	0.010	0.003	0.508
Total	1.303	0.108	0.354	0.408	0.080	2.253
B8-I	0.235	0.010	-	-	0.065	0.310
B8-II	0.305	0.008	0.038	0.293	0.032	0.676
B8-III	0.339	0.007	0.370	-	0.065	0.781
B8-IV	0.372	0.015	0.009	-	0.027	0.423
Total	1.251	0.040	0.417	0.293	0.189	2.190
B9-I	0.119	0.048	0.047	-	0.051	0.265
B9-II	0.341	0.014	0.039	-	0.153	0.547
B9-III	0.437	0.018	0.037	-	0.016	0.508
B9-IV	0.348	0.026	0.011	-	0.018	0.403
Total	1.245	0.106	0.134	-	0.238	1.723
B10-I	0.011	0.070	-	-	-	0.081
B10-II	0.045	0.010	-	-	-	0.055
B10-III	0.130	0.015	0.119	-	-	0.264
B10-IV	0.025	0.028	-	-	-	0.053
Total	0.211	0.123	0.119	-	-	0.453
B11-I	0.416	0.681	0.019	-	0.131	1.247
B11-II	0.220	0.734	0.128	-	0.062	1.144
B11-III	0.072	0.601	0.071	-	0.089	0.833
B11-IV	0.069	0.598	0.114	-	0.062	0.843
Total	0.777	2.614	0.332	-	0.344	4.067
B12-I	0.267	1.071	0.059	-	0.435	1.832
B12-II	0.179	0.774	0.014	-	0.157	1.124
B12-III	0.195	0.937	0.047	-	0.435	1.614
B12-IV	0.085	0.962	0.002	-	0.130	1.179
Total	0.726	3.744	0.122	-	1.157	5.749
Grand Total	22.805	10.867	3.475	1.048	4.580	42.775

Note: - = no animals

Appendix G-5. Yearly infauna abundance, 1988-2001. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Phylum Species	Year													Total
	1988 W	1988 S	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	Total	
AR <i>Monocorophium acherusicum</i>	-	-	-	-	-	-	-	-	26	-	18	163	76	16420
AN <i>Mediomastus</i> spp	56	45	243	533	486	291	716	418	467	170	123	310	3858	
AN <i>Apopriionospio pygmaea</i>	68	62	103	378	448	213	536	364	384	181	116	165	3018	
AR <i>Ericthonius brasiliensis</i>	-	-	-	-	-	-	-	4	-	-	2	2806	2812	
AN <i>Owenia collaris</i>	1	-	6	262	54	41	21	149	124	45	1214	336	2253	
AN <i>Mediomastus acutus</i>	-	14	-	-	-	-	-	216	299	211	283	336	1359	
NT <i>Nematoda</i>	2	1	3	5	8	3	10	1164	3	7	10	7	1223	
AR <i>Grandidierella japonica</i>	1	-	-	2	1	-	-	-	19	-	4	932	959	
AR <i>Diastylopsis tenuis</i>	17	39	37	57	21	190	77	16	30	38	118	87	727	
AN <i>Streblospio benedicti</i>	-	-	-	-	-	-	-	-	-	-	-	630	630	
AR <i>Amphideutopus ovalatus</i>	1	20	18	13	8	6	77	265	24	22	107	29	590	
AN <i>Prionospio (Minuspio) lighti</i>	1	19	65	232	15	39	63	74	5	41	15	11	580	
AR <i>Euphilomedes longiseta</i>	-	8	-	41	-	110	5	241	4	60	34	19	522	
AN <i>Goniada littorea</i>	39	33	76	51	32	44	36	14	19	67	55	54	520	
AR <i>Euphilomedes carcharodonta</i>	2	13	32	36	45	23	89	25	16	36	60	33	410	
AN <i>Leitoscoloplos puggettensis</i>	6	3	14	33	51	22	54	75	18	37	25	19	357	
AN <i>Streblosoma</i> sp B SCAMIT 1985	-	-	-	-	1	1	4	4	-	2	1	325	338	
AN <i>Spiophanes bombyx</i>	7	9	4	22	16	27	29	26	43	50	36	52	321	
AN <i>Chaetozone setosa</i> Cmplx	-	-	6	46	96	13	59	44	10	15	20	11	320	
AR <i>Rhepoxynius menziesi</i>	9	13	41	24	24	43	40	12	16	18	40	27	307	
AN <i>Scoleloma tetraura</i> Cmplx	3	-	7	6	20	30	66	81	-	43	25	8	289	
AN <i>Monticellina cryptica</i>	-	-	-	-	51	25	43	38	8	47	36	37	285	
AN <i>Spiophanes duplex</i>	-	3	7	10	66	21	30	66	21	3	2	51	280	
AN <i>Nephtys cornuta</i>	1	2	3	26	29	10	67	32	-	43	3	34	250	
MO <i>Tellina modesta</i>	4	8	9	40	21	10	67	32	11	4	20	24	250	
AN <i>Amaeana occidentalis</i>	1	8	26	18	13	32	24	32	6	24	24	23	231	
AN <i>Capitella capitata</i> Cmplx	-	-	-	-	-	-	-	2	-	-	-	221	223	
AN <i>Euchone incolor</i>	-	-	2	13	2	-	148	21	1	5	12	19	223	
AR <i>Elasmopus bampo</i>	-	-	-	2	-	-	-	1	-	-	-	213	216	
NE <i>Tubulanus polymorphus</i>	3	-	25	14	75	14	31	9	3	9	14	18	215	
AN <i>Aphelochaeta glandaria</i>	-	-	-	-	-	-	68	87	1	16	15	15	202	
AN <i>Cossura</i> sp A Phillips 1987	-	-	-	-	-	-	-	18	-	23	48	103	192	
AN <i>Cossura candida</i>	-	3	12	7	15	115	37	-	-	-	-	-	189	
MO <i>Mactrotoma californica</i>	-	-	-	2	-	6	7	102	17	-	50	4	188	
AN <i>Hesionura coineaui difficilis</i>	-	-	-	-	-	-	-	184	-	-	-	-	184	
MO <i>Cooperella subdiaphana</i>	-	7	3	9	1	51	54	21	10	5	7	10	178	
AN <i>Chaetozone corona</i>	4	3	5	10	23	35	37	24	-	17	14	5	177	
AR <i>Argissa hamatipes</i>	1	4	3	9	42	12	11	12	34	19	20	10	177	
AN <i>Aricidea (Acmina) catherinae</i>	5	1	11	6	22	17	22	36	8	23	9	13	173	
AN <i>Cirriformia</i> sp	2	-	1	-	-	-	-	-	-	-	-	170	173	
AN <i>Nephtys caecoides</i>	2	7	13	26	16	6	34	12	15	14	9	19	173	
AR <i>Zeuxo normani</i>	-	-	-	1	153	-	12	1	1	-	-	4	172	
AR <i>Parapriionospio pinnata</i>	3	11	8	18	22	20	39	10	1	18	13	-	163	
AN <i>Nereis procta</i>	5	2	8	6	23	14	28	21	-	15	19	19	160	
MO <i>Rochefortia coani</i>	1	3	-	5	11	7	11	93	1	1	11	9	153	
AN <i>Tharyx</i> spp	17	21	46	66	-	1	-	-	-	-	-	-	151	
AN <i>Maldanidae</i>	-	-	1	-	-	-	44	53	-	24	27	-	149	
AR <i>Photis brevipes</i>	-	-	-	14	-	2	5	17	17	32	40	19	146	
MO <i>Siliqua lucida</i>	-	2	-	-	2	101	32	1	1	2	2	2	145	
AR <i>Rudimemboides stenopropodus</i>	-	4	5	7	12	2	15	75	10	1	7	3	141	
CN <i>Actinaria</i>	-	-	-	-	3	1	-	-	-	-	-	-	136	
MO <i>Solen sicarius</i>	-	-	2	2	-	60	6	25	37	2	1	-	135	
AN <i>Pectinaria californiensis</i>	2	17	2	1	9	11	22	19	1	12	29	7	132	
AN <i>Ampharete labrops</i>	-	4	1	12	3	9	31	5	19	12	25	3	124	
AN <i>Sphaerosyllis californiensis</i>	-	-	-	-	-	-	-	-	1	-	1	120	122	
AR <i>Rhepoxynius</i> sp A SCAMIT 1987	5	5	31	17	6	13	17	7	1	2	10	3	117	
AR <i>Americichelidium shoemakeri</i>	-	7	1	12	8	7	28	2	8	4	16	21	114	
NE <i>Carinoma mutabilis</i>	2	4	11	10	33	7	7	3	6	13	10	8	114	
AN <i>Polydora cirrosa</i>	-	-	-	-	-	-	35	13	-	11	49	108		
AR <i>Gibberosus myersi</i>	1	4	3	4	10	8	9	3	17	5	32	8	104	
AN <i>Pista disjuncta</i>	-	-	-	15	4	8	12	9	5	14	22	11	100	
AN <i>Lumbineris</i> sp	2	5	20	10	28	33	-	-	-	-	1	99		
AN <i>Scoloplos armiger</i> Cmplx	-	3	2	4	8	-	5	62	11	-	2	1	98	
NE <i>Lineidae</i>	1	3	1	-	7	5	4	13	28	15	16	5	98	
PR <i>Phorona</i>	3	3	8	19	14	12	6	9	6	-	4	13	97	
AR <i>Leptochelia dubia</i>	-	2	7	15	6	2	30	28	1	3	-	2	96	
AN <i>Monticellina tessellata</i>	-	-	-	-	71	20	3	-	-	1	-	-	95	
MO <i>Macoma yoldiformis</i>	-	-	1	1	5	11	33	5	7	6	16	10	95	
AN <i>Euclymeninae</i>	-	1	3	6	58	13	-	-	-	-	-	7	88	
AR <i>Rutiderma rostratum</i>	1	-	6	1	7	11	10	10	1	2	23	11	83	
AR <i>Paranthura elegans</i>	-	-	-	-	3	-	-	-	1	-	-	75	79	
AR <i>Uromunna ubiquita</i>	-	3	-	2	1	1	5	3	45	3	11	3	77	
NE <i>Nemertea</i>	5	3	8	3	6	7	19	4	1	2	11	5	74	
NE <i>Paranemertes californica</i>	-	-	4	5	13	5	18	11	3	1	7	6	73	
AR <i>Leptocuma forsmanni</i>	-	7	6	15	2	12	9	2	13	3	3	3	72	
AR <i>Oxyurostylis pacifica</i>	2	5	4	10	9	4	4	14	4	6	5	3	70	
AN <i>Glycinde armigera</i>	-	-	5	15	8	5	8	2	-	8	5	11	67	
CN <i>Zaolutus actius</i>	-	-	-	-	-	5	4	1	28	3	9	16	66	

Appendix G-5. (Cont.).

Phylum Species	Year												Total
	1988 W	1990 S	1991	1992	1993	1994	1997	1998	1999	2000	2001		
MO <i>Macoma</i> sp	-	3	1	16	6	28	-	-	-	8	4	66	
AN <i>Euclymeninae</i> sp A SCAMIT 1987	-	-	-	-	-	23	22	3	8	-	9	65	
AN <i>Levinsenia gracilis</i>	-	-	6	3	15	-	11	23	-	3	-	3	64
MO <i>Rochefortia grippi</i>	-	6	1	-	-	-	27	28	-	-	-	1	63
AR <i>Paracerceis sculpta</i>	-	-	-	-	-	-	-	-	-	-	-	62	62
CO <i>Enteropneusta</i>	-	-	1	10	2	2	5	7	3	2	15	15	62
MO <i>Mysella pedroana</i>	-	-	12	-	26	4	-	19	-	1	-	-	62
AN <i>Notomastus tenuis</i>	1	-	2	1	-	5	-	18	1	25	6	-	59
AR <i>Hartmanodes hartmanae</i>	4	-	3	1	4	1	9	10	8	5	3	11	59
AN <i>Amphicteis scaphobranchiata</i>	-	-	2	4	8	6	7	7	1	16	2	5	58
AN <i>Aricidea (Aricidea) wassi</i>	1	-	6	11	11	3	11	11	-	-	1	3	58
AR <i>Pinnixa longipes</i>	-	-	10	3	6	10	8	11	-	9	1	-	58
AR <i>Ampelisca brachycladus</i>	-	2	5	-	2	2	39	2	-	2	3	-	57
AR <i>Podocerus fulanus</i>	-	-	-	-	-	-	-	-	-	-	-	57	57
AR <i>Anoropallene palpida</i>	-	-	-	6	28	5	-	-	17	-	-	-	56
CN <i>Edwardsia</i> sp G MEC 1992	-	-	6	4	11	10	-	2	-	2	3	15	53
AR <i>Neotrypaea californiensis</i>	-	-	-	-	-	13	4	12	-	10	8	2	49
MO <i>Barlecia subtenuis</i>	-	-	-	-	-	-	-	-	-	-	-	48	48
MO <i>Turbanilla santarosana</i>	-	2	-	-	3	5	26	1	2	2	4	2	47
AN <i>Spiochaetopterus costarum</i>	2	7	1	5	-	1	9	3	-	-	1	17	46
AN <i>Praxillella pacifica</i>	-	-	1	1	2	16	9	6	-	8	1	1	45
AR <i>Cumella californica</i>	-	1	1	6	-	1	10	17	-	2	6	1	45
MO <i>Cyclostremella dalli</i>	-	-	-	5	3	2	-	5	3	-	8	19	45
AN <i>Neosabellaria cementarium</i>	-	-	-	-	-	-	-	-	1	1	16	26	44
MO <i>Odostomia</i> sp D MBC 1980	1	2	-	-	4	22	6	-	-	1	3	5	44
MO <i>Crepidula naticarum</i>	3	-	1	-	1	2	2	3	5	-	26	-	43
MO <i>Tagelus subteres</i>	-	-	-	-	-	-	-	41	1	-	-	1	43
AN <i>Spio filicornis</i>	-	-	-	-	-	-	-	-	-	-	-	42	42
AR <i>Leptostylis calva</i>	-	-	-	1	-	6	1	8	-	5	10	10	41
MO <i>Olivella baetica</i>	3	3	-	6	1	-	10	2	1	1	4	10	41
MO <i>Sulcoretusa xystrum</i>	2	6	1	8	5	6	13	-	-	-	-	-	41
AN <i>Podarkeopsis glabra</i>	2	3	7	7	2	2	10	1	1	1	2	2	40
AR <i>Postasterope barnesi</i>	-	3	1	5	7	1	6	13	1	-	1	2	40
PL <i>Notoplana</i> sp	-	-	-	-	-	-	-	-	-	-	-	40	40
AN <i>Glycera nana</i>	-	-	-	-	2	-	5	4	2	15	11	-	39
AR <i>Pyromnia tuberculata</i>	-	-	-	-	1	-	1	5	1	3	10	17	38
AN <i>Magelona sacculata</i>	1	7	2	12	11	1	-	-	-	-	-	1	35
AN <i>Podarkeopsis</i> sp A Harris & Velarde 1983	-	-	-	-	-	-	17	1	-	6	5	6	35
AR <i>Ampelisca cristata cristata</i>	-	3	8	5	3	4	11	-	-	1	-	-	35
AN <i>Saccocirrus papillocerous</i>	-	-	-	-	-	-	-	34	-	-	-	-	34
AR <i>Edolia sublittoralis</i>	-	-	-	4	2	7	1	9	5	-	4	2	34
AN <i>Carazzziella</i> sp A SCAMIT 1995	-	-	-	-	-	-	1	5	-	24	2	1	33
AN <i>Sabellaria gracilis</i>	-	-	-	-	-	-	-	-	-	29	4	-	33
AN <i>Diopatra splendidissima</i>	-	1	-	1	-	-	1	4	6	11	7	1	32
AN <i>Malmgreniella macginitiae</i>	-	3	3	-	-	-	-	1	-	9	8	8	32
AR <i>Melinna oculata</i>	-	-	-	1	11	5	3	6	-	6	-	-	32
MO <i>Cadulus aberrans</i>	-	-	-	1	1	1	2	4	-	6	9	7	32
AR <i>Photis macinerneyi</i>	-	11	-	-	5	1	2	1	-	6	5	-	31
AN <i>Polydora websteri</i>	-	-	2	-	-	27	-	-	-	1	-	30	
AR <i>Photis bifurcata</i>	-	-	-	-	-	-	-	24	1	1	3	1	30
AN <i>Aphelochaeta monilaris</i>	-	-	-	-	2	-	2	2	-	2	3	18	29
AN <i>Neanthes acuminata</i> Cmplx	-	-	-	-	-	-	-	-	-	-	-	29	29
AN <i>Chone albocincta</i>	-	-	-	-	7	4	3	14	-	-	-	-	28
AN <i>Laonice cirrata</i>	-	-	-	-	2	7	1	1	-	8	3	6	28
AN <i>Polydora cornuta</i>	-	-	-	-	-	-	-	-	22	-	-	6	28
AR <i>Harpacticoida</i>	-	-	-	-	-	17	-	8	-	1	2	-	28
MO <i>Rictaxis punctocaelatus</i>	-	-	-	1	1	-	10	8	3	1	4	-	28
AN <i>Aricidea (Acmina) horikoshii</i>	-	-	2	1	1	2	1	7	1	3	4	5	27
AN <i>Goniada maculata</i>	5	-	4	2	4	2	2	1	-	3	1	3	27
AN <i>Scoletoma</i> sp	-	-	-	1	5	-	1	19	-	-	-	1	27
EC <i>Dendraster excentricus</i>	-	-	-	-	-	-	-	-	-	-	-	1	27
MO <i>Crepidula norrisiarum</i>	-	-	-	-	-	-	-	-	-	18	-	9	27
MO <i>Theora lubrica</i>	-	-	-	-	-	8	4	11	-	1	2	1	27
AN <i>Cirriformia moorei</i>	-	-	-	-	-	-	-	2	3	7	9	5	26
AN <i>Glycera americana</i>	-	-	1	3	8	1	3	1	-	3	3	3	26
EC <i>Ophiuroidea</i>	-	1	1	-	10	1	4	3	-	1	4	1	26
AN <i>Sigalion spinosus</i>	1	5	2	-	2	1	5	-	2	4	1	2	25
AN <i>Spiophanes berkeleyorum</i>	1	-	3	1	-	3	5	-	4	7	1	25	
AN <i>Terebellidae</i>	-	-	-	2	19	2	-	-	-	-	-	2	25
MO <i>Turbanilla painei</i>	-	1	3	1	1	1	15	3	-	-	-	-	25
NE <i>Tubulanus nothus</i>	-	-	5	1	3	3	3	3	-	5	2	-	25
AN <i>Lumbrinerides platypygos</i>	-	-	-	-	-	-	-	-	-	23	-	-	23
AN <i>Chone</i> sp SD 1 Pt. Loma 1997	-	-	-	-	-	-	-	-	3	5	11	3	22
AN <i>Onuphis eremita parva</i>	1	-	-	-	-	5	-	6	1	7	2	-	22
AN <i>Protodorvillea gracilis</i>	-	-	-	-	-	-	-	22	-	-	-	-	22
AN <i>Tenonia priops</i>	1	-	1	2	7	-	6	1	-	1	2	1	22
AR <i>Neotrypaea</i> spp	-	7	13	-	2	-	-	-	-	-	-	-	22
AN <i>Dipolydora socialis</i>	-	-	-	-	-	-	-	-	-	1	20	21	

Appendix G-5. (Cont.).

Phylum	Species	Year												Total
		1988 W	1988 S	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	
AR	<i>Hemilamprops californica</i>	-	-	-	-	1	8	1	2	-	3	2	4	21
EC	<i>Amphidia digitata</i>	-	-	-	-	1	2	4	9	-	1	-	4	21
EC	<i>Amphiura arcystata</i>	-	-	1	-	1	10	3	-	-	6	-	-	21
AN	<i>Poecilochaetus</i> sp A Martin 1977	-	-	-	-	1	3	14	2	-	-	-	-	20
AN	<i>Syllis (Typosyllis) farallonensis</i>	-	-	-	-	-	-	6	5	3	1	5	-	20
AR	<i>Listriella goleta</i>	-	-	-	-	2	-	2	6	4	-	2	2	20
AN	<i>Glycera macrobranchia</i>	1	1	1	-	2	3	-	1	7	-	1	2	19
AR	<i>Acuminodeutopus heteruropus</i>	-	-	-	-	-	-	15	1	1	-	2	-	19
MO	<i>Tagelus</i> sp	-	-	-	-	-	-	3	-	-	-	-	16	19
NE	<i>Cerebratulus californiensis</i>	-	-	-	-	-	-	5	9	-	4	1	-	19
PL	<i>Stylochoplana</i> sp	-	-	3	4	7	1	3	-	-	1	-	-	19
AR	<i>Anoplodactylus viridintestinalis</i>	-	-	-	-	-	-	-	-	-	-	-	18	18
AR	<i>Campylaspis rubromaculata</i>	-	1	-	4	5	4	-	-	-	-	4	-	18
AR	<i>Metamysidopsis elongata</i>	-	-	1	-	3	4	3	3	2	1	-	1	18
AR	<i>Pinnixa franciscana</i>	-	-	2	4	-	-	1	-	-	7	2	2	18
AR	<i>Podocerus brasiliensis</i>	1	-	-	17	-	-	-	-	-	-	-	-	18
EC	<i>Amphiuridae</i>	-	-	-	8	-	-	1	-	5	-	-	4	18
MO	<i>Modiolus</i> sp	-	-	-	-	1	3	3	-	-	3	2	6	18
MO	<i>Philine</i> sp A SCAMIT 1988	-	-	-	-	4	3	5	-	-	5	-	1	18
MO	<i>Solen rostriformis</i>	1	3	-	-	6	-	5	-	-	-	-	3	18
AN	<i>Armandia brevis</i>	-	1	-	-	1	-	6	1	-	-	1	7	17
AN	<i>Onuphis</i> sp 1 Pt. Loma 1983	-	-	-	-	-	5	1	5	4	-	-	2	17
AR	<i>Balanus pacificus</i>	-	1	-	-	-	-	2	-	-	-	13	1	17
AR	<i>Parasterope hulingsi</i>	-	-	-	-	-	-	-	-	-	1	12	4	17
AR	<i>Pseudopolydora paucibranchiata</i>	-	-	-	-	-	-	1	1	15	-	-	-	17
MO	<i>Rochefortia tumida</i>	-	1	1	1	1	1	5	3	1	-	2	1	17
AN	<i>Metasychis dispareidentatus</i>	1	-	2	2	5	3	1	2	-	-	-	-	16
AN	<i>Ophryotrocha</i> sp	-	-	-	-	-	-	-	-	-	-	-	16	16
AR	<i>Pinnixa</i> sp	-	1	4	3	2	4	-	2	-	-	-	-	16
AN	<i>Eranno lagunae</i>	-	-	-	-	1	-	-	-	13	1	-	-	15
AN	<i>Magelona piteikai</i>	-	-	-	-	12	-	1	1	-	-	-	1	15
EC	<i>Amphidia urtica</i>	1	2	-	10	-	-	-	-	-	-	2	-	15
MO	<i>Kurtziella plumbea</i>	-	2	-	-	-	-	6	2	-	2	1	2	15
MO	<i>Nuculana taphria</i>	-	-	-	-	2	2	5	-	-	2	-	4	15
MO	<i>Parvilucina tenuisculpta</i>	-	-	-	-	1	3	4	6	-	-	1	-	15
PR	<i>Phoronopsis</i> sp	-	-	-	-	-	-	-	-	-	2	3	10	15
AN	<i>Chone mollis</i>	-	-	-	1	1	1	5	3	-	-	1	2	14
AN	<i>Glycera branchiopoda</i>	-	-	-	-	-	-	-	-	-	-	-	14	14
AN	<i>Hamtothoe</i> sp	-	-	-	-	11	3	-	-	-	-	-	-	14
AR	<i>Aerooides intermedius</i>	-	-	-	-	-	-	-	-	-	-	10	4	14
AR	<i>Scleropax granulatus</i>	-	1	-	12	-	1	-	-	-	-	-	-	14
MO	<i>Cumigia californica</i>	-	-	-	-	-	3	6	4	1	-	-	-	14
MO	<i>Periploma discus</i>	-	-	-	1	-	1	3	-	-	4	-	5	14
AN	<i>Goniada</i> sp	12	-	-	-	-	-	-	1	-	-	-	-	13
AN	<i>Polydora nuchalis</i>	-	-	-	-	-	-	12	-	-	-	-	1	13
AR	<i>Ampelisca brevisimulata</i>	-	-	2	-	1	1	5	1	-	1	1	1	13
AR	<i>Cerapus tubularis</i> Cmplx	-	1	-	-	-	-	4	-	7	1	-	-	13
AR	<i>Gammaidea</i>	-	-	1	-	2	2	-	1	-	-	-	7	13
AR	<i>Gammaropsis thompsoni</i>	-	-	-	6	-	-	-	-	-	-	7	-	13
AR	<i>Mysidopsis intii</i>	-	-	1	1	-	1	-	2	1	3	3	1	13
MO	<i>Odostomia</i> sp	-	-	-	4	-	8	-	-	-	-	-	1	13
AN	<i>Lumbrineridae</i>	-	-	-	-	-	-	-	-	-	-	2	10	12
AN	<i>Malmgreniella</i> spp	-	-	-	1	-	-	4	7	-	-	-	-	12
AN	<i>Phylodoce hartmanae</i>	-	-	-	-	6	2	-	-	-	-	-	4	12
AN	<i>Sigambra tentaculata</i>	-	-	3	-	1	6	2	-	-	-	-	-	12
MO	<i>Lyonsia californica</i>	-	-	-	-	1	-	6	-	-	4	1	-	12
NE	<i>Micura</i> sp	-	1	-	-	1	-	-	-	-	9	1	-	12
PR	<i>Phoronis</i> sp	-	-	-	-	-	-	-	-	-	5	-	7	12
AN	<i>Eumida longicornuta</i>	-	-	-	-	1	2	-	-	-	-	1	7	11
AN	<i>Marphysa</i> sp A Harris & Velarde 1983	-	-	-	-	-	-	-	-	-	3	6	2	11
AN	<i>Onuphis iridescentis</i>	1	-	2	3	3	-	-	-	2	-	-	-	11
AN	<i>Parapionospio pinnata</i>	-	-	-	-	-	-	-	-	-	-	-	11	11
AN	<i>Pherusa neopapillata</i>	-	-	-	-	8	-	2	-	-	1	-	-	11
AN	<i>Syllis (Typosyllis) aciculata</i>	-	-	-	-	3	5	-	-	-	-	-	3	11
AR	<i>Isocheles pilosus</i>	-	-	2	-	4	1	1	1	-	-	1	1	11
AR	<i>Lamprops carinatus</i>	-	-	-	-	-	-	-	2	2	-	1	6	11
MO	<i>Rochefortia compressa</i>	-	-	-	-	1	1	3	-	-	-	2	4	11
NE	<i>Amphiporus</i> sp	-	-	1	1	1	1	1	1	-	4	-	1	11
NE	<i>Tetrasymma</i> sp A SCAMIT 1995	-	-	-	-	-	-	-	8	1	-	-	2	11
AN	<i>Axiothella rubrocincta</i>	2	-	-	-	-	-	-	8	-	-	-	-	10
AN	<i>Cirriformia spirabranchia</i> *	-	1	-	-	1	-	5	3	-	-	-	-	10
AN	<i>Oligochaeta</i>	-	-	-	-	-	-	-	1	-	2	-	7	10
AN	<i>Onuphis eremita</i>	-	-	2	-	1	-	3	-	4	-	-	-	10
AN	<i>Scalibregma californicum</i>	-	-	-	-	-	1	1	2	-	-	2	4	10
AN	<i>Syllis</i> spp	-	-	4	6	-	-	-	-	-	-	-	-	10
AR	<i>Ancinus granulatus</i>	-	2	1	5	-	1	-	-	-	-	-	1	10
AR	<i>Campylaspis</i> sp C Myers & Benedict 1974	-	-	-	-	3	4	-	3	-	-	-	-	10
CN	<i>Limnactinidae</i> sp A SCAMIT 1989	-	-	3	2	1	2	1	1	-	-	-	-	10

Appendix G-5. (Cont.).

Phylum	Species	Year												Total
		1988	1989	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	
MO	<i>Cylichna diegensis</i>	-	-	-	3	-	1	5	-	-	1	-	-	10
MO	<i>Macoma nasuta</i>	-	3	-	-	-	-	-	5	-	1	1	-	10
MO	<i>Pelecypoda</i>	-	-	-	1	-	2	7	-	-	-	-	-	10
MO	<i>Philine bakeri</i>	-	1	-	-	5	1	1	-	2	-	-	-	10
AN	<i>Eteone fauchaldi</i>	-	1	-	1	-	-	-	1	-	4	2	-	9
AN	<i>Euchone limnicola</i>	-	1	-	-	-	-	-	1	-	2	4	1	9
AN	<i>Exogone louriei</i>	1	-	-	-	-	1	-	-	3	-	-	1	9
AN	<i>Exogone uniformis</i>	-	-	-	2	-	-	7	-	-	-	-	-	9
AN	<i>Hesionella mccullochae</i>	-	-	-	3	-	-	-	3	2	-	-	1	9
AN	<i>Notomastus</i> sp A SCAMIT 2001	-	-	-	-	-	-	-	-	-	-	-	9	9
AN	<i>Sthenelais tertiglabra</i>	-	-	-	-	-	1	-	1	-	3	-	3	9
AN	<i>Terebellides californica</i>	-	-	-	-	-	2	-	1	-	-	1	5	9
AR	<i>Ogyrides</i> sp A Roney 1978	-	-	-	1	2	2	2	-	-	1	-	1	9
AR	<i>Pachynus barnardi</i>	-	1	-	-	-	2	4	1	-	1	-	-	9
AR	<i>Tiburonella viscana</i>	-	-	-	-	-	-	-	9	-	-	-	-	9
BC	<i>Gloeoidea albida</i>	-	-	-	1	-	3	3	-	-	-	-	2	9
MO	<i>Acteocina harpa</i>	-	1	-	-	-	-	3	2	-	2	-	1	9
MO	<i>Crepidula</i> sp	-	1	-	-	-	-	-	-	-	-	-	8	9
MO	<i>Turbonilla</i> sp O MBC 1982	-	-	-	-	-	-	-	6	3	-	-	-	9
NE	<i>Tetrasymmetra</i> sp	-	-	-	2	2	5	-	-	-	-	-	-	9
AN	<i>Diopatra</i> sp	-	1	-	-	-	-	-	5	-	1	-	1	8
AN	<i>Glycera</i> sp	-	1	-	5	-	-	-	-	-	2	-	-	8
AN	<i>Nephys</i> sp	3	5	-	-	-	-	-	-	-	-	-	-	8
AR	<i>Ampelisca agassizi</i>	-	-	1	2	-	-	-	-	-	-	-	5	8
AR	<i>Brachyura</i> , megalopa	-	-	1	-	3	2	-	1	-	-	-	1	8
AR	<i>Caprella mendax</i>	-	-	-	-	-	-	-	-	-	-	1	7	8
AR	<i>Leuroleberis sharpei</i>	-	-	-	-	1	-	1	1	1	-	2	2	8
EC	<i>Leptosynapta</i> sp	-	1	2	1	-	-	1	3	-	-	-	-	8
MO	<i>Balcis oldroydæ</i>	1	-	1	2	1	2	-	1	-	-	-	-	8
PL	<i>Imogene exigua</i>	-	-	1	-	1	-	3	1	-	1	1	-	8
AN	<i>Arabella endonata</i>	1	-	-	-	1	-	2	-	-	3	-	-	7
AN	<i>Lumbrineris japonica</i>	-	-	-	-	-	-	-	-	-	4	3	-	7
AN	<i>Nereis latescens</i>	-	-	-	-	-	-	-	-	-	-	2	5	7
AN	<i>Phylodoce pectiniferae</i>	-	-	-	-	-	-	-	7	-	-	-	-	7
AN	<i>Polycirrus californicus</i>	-	-	-	-	-	-	-	-	2	-	3	2	7
AR	<i>Ampithoe valida</i>	-	-	-	-	-	-	-	-	-	-	-	7	7
AR	<i>Aoroides inermis</i>	3	-	-	-	-	-	-	-	-	4	-	-	7
AR	<i>Aoroides</i> sp	-	-	-	1	-	5	-	-	-	-	-	1	7
AR	<i>Cyclaspis nubila</i>	-	-	-	-	4	1	-	-	-	-	1	1	7
AR	<i>Cyclaspis</i> sp C SCAMIT 1986	-	-	-	-	-	1	1	1	-	-	3	1	7
AR	<i>Listriella diffusa</i>	-	-	-	-	-	2	-	1	-	-	4	-	7
AR	<i>Munnogonium tillerae</i>	-	-	-	1	4	-	-	-	-	-	2	-	7
AR	<i>Tanopsis californica</i>	-	-	-	-	-	-	-	7	-	-	-	-	7
EC	<i>Amphiodia</i> sp	-	-	-	-	-	3	2	-	-	-	-	2	7
MO	<i>Hiatella arctica</i>	-	-	-	-	-	-	-	-	-	-	-	7	7
MO	<i>Nassarius perpinguis</i>	-	-	-	2	-	3	1	1	-	-	-	-	7
MO	<i>Neverita reclusiana</i>	2	1	-	1	-	-	2	-	-	1	-	-	7
MO	<i>Odostomia raymondi</i>	-	-	-	-	-	-	5	2	-	-	-	-	7
MO	<i>Protothaca staminea</i>	-	-	-	-	-	-	-	-	-	-	7	-	7
SI	<i>Thysanocardia nigra</i>	-	-	1	4	-	-	-	1	-	-	-	1	7
AN	<i>Chone veleronis</i>	-	-	-	1	-	-	2	2	1	-	-	-	6
AR	<i>Americhelidium rectipalmum</i>	-	-	-	-	-	-	-	-	1	-	3	2	6
AR	<i>Eusarsiella thominx</i>	-	-	-	1	1	1	-	3	-	-	-	-	6
AR	<i>Photis</i> sp	-	2	-	1	-	-	3	-	-	-	-	-	6
MO	<i>Amiantis callosa</i>	-	1	1	-	-	1	-	2	-	1	-	-	6
AN	<i>Anatomastus gordioides</i>	-	1	-	-	1	2	-	1	-	-	-	5	5
AN	<i>Arabella semimaculata</i>	-	-	-	-	-	-	-	-	-	-	-	5	5
AN	<i>Caulieriella alata</i>	-	-	-	-	-	-	-	1	-	-	4	-	5
AN	<i>Chaetozone spinosa</i>	-	-	-	-	-	-	-	-	-	5	-	-	5
AN	<i>Lumbrineris californiensis</i>	-	-	-	1	-	-	2	1	-	-	1	2	5
AN	<i>Nereididae</i>	-	-	-	2	-	-	-	-	-	1	-	-	5
AN	<i>Prionospio cirrifer</i>	-	-	-	-	5	-	-	-	-	-	-	-	5
AN	<i>Prionospio</i> sp A SCAMIT 1991	-	-	2	-	-	-	-	3	-	-	-	-	5
AN	<i>Sthenelainella uniformis</i>	-	-	-	-	-	-	4	1	-	-	-	-	5
AR	<i>Clausidium vancouverense</i>	-	-	-	1	-	-	-	2	-	2	-	-	5
AR	<i>Melphisana bola</i> CrmPb	-	-	-	-	-	1	2	-	1	1	-	-	5
AR	<i>Monocorophium insidiosum</i>	-	-	-	-	-	-	5	-	-	-	-	-	5
AR	<i>Pinnotheridae</i>	-	-	-	1	4	-	-	-	-	-	-	-	5
CN	<i>Epiactis prolifera</i>	-	-	-	-	-	-	-	-	-	-	-	5	5
CO	<i>Agnezia septentrionalis</i>	-	-	-	-	-	-	1	-	-	2	-	2	5
EP	<i>Cryptoorachnidium argilla</i>	-	-	-	-	-	-	-	-	-	-	3	2	5
EP	<i>Thalamoporella californica</i>	-	-	-	4	1	-	-	-	-	-	-	-	5
MO	<i>Kurtzina beta</i>	-	-	-	-	2	2	-	-	-	-	-	1	5
MO	<i>Solen</i> sp	1	-	1	2	-	-	1	-	-	-	-	-	5
MO	<i>Turbonilla paramoëa</i>	1	-	-	-	-	2	1	-	-	1	-	-	5
MO	<i>Vitrinella oldroydi</i>	-	-	2	-	-	-	-	-	-	-	3	-	5
MO	<i>Volvulella panamica</i>	-	-	-	-	2	2	-	-	-	1	-	-	5
NE	<i>Hoplonemertea</i> sp A Paquette 1988	1	-	1	-	1	-	1	-	-	1	-	-	5

Appendix G-5. (Cont.).

Phylum	Species	Year												Total
		1988 W	1988 S	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	
NE	<i>Tubulanus frenatus</i>	-	-	-	-	2	-	-	3	-	-	-	-	5
AN	<i>Aricidea (Aedicira) pacifica</i>	-	-	-	-	3	-	-	-	-	1	-	-	4
AN	<i>Autolytus</i> sp	-	-	-	4	-	-	-	-	-	-	-	-	4
AN	<i>Chone</i> sp	-	-	-	3	-	-	-	-	1	-	-	-	4
AN	<i>Clymenella</i> sp A Harris 1985	-	1	-	-	-	2	1	-	-	-	-	-	4
AN	<i>Diopatra ornata</i>	-	-	-	-	1	2	-	-	-	-	1	-	4
AN	<i>Dipolydora giardi</i>	-	-	-	-	-	-	-	-	-	-	-	4	4
AN	<i>Dorvillea (Schistomerings) longicornis</i>	-	-	-	-	-	-	2	1	-	1	-	-	4
AN	<i>Drilonereis longa</i>	-	-	-	-	-	-	-	-	-	-	3	1	4
AN	<i>Drilonereis</i> sp A SCAMIT 1998	-	-	-	-	-	1	-	-	3	-	-	-	4
AN	<i>Lumbrineris latreilli</i>	-	-	-	-	-	-	-	-	-	-	-	4	4
AN	<i>Lysippe</i> sp A Williams 1985	-	-	-	-	-	-	-	4	-	-	-	-	4
AN	<i>Marpphysa sanguinea</i>	-	-	-	-	-	-	-	-	-	-	-	4	4
AN	<i>Melinna oculata</i>	-	-	-	-	-	-	-	-	-	-	-	4	4
AN	<i>Paleanotus bellis</i>	-	-	-	-	-	-	-	-	-	4	-	-	4
AN	<i>Phyllodoce hartmanae</i>	-	-	-	-	-	-	-	1	-	3	-	-	4
AN	<i>Phyllodoce longipes</i>	-	-	-	-	-	-	2	1	1	-	-	-	4
AN	<i>Platynereis bicanaliculata</i>	-	-	-	-	-	-	-	-	-	1	1	2	4
AN	<i>Poecilochaetus johnsoni</i>	-	1	-	1	-	-	1	-	-	-	-	1	4
AN	<i>Polycirrus</i> spp	-	-	-	-	2	-	1	-	-	-	1	-	4
AN	<i>Polydora limicola</i>	-	1	1	-	-	1	-	-	-	1	-	-	4
AN	<i>Prionospio (Prionospio) heterobranchia</i>	-	-	-	-	-	-	-	2	2	-	-	-	4
AN	Sabellidae	-	-	2	1	-	1	-	-	-	-	-	-	4
AN	<i>Sigambra bassi</i>	-	-	-	-	-	-	-	-	-	-	4	-	4
AN	<i>Spirochaetopterus</i> sp A SCAMIT *	-	-	-	-	4	-	-	-	-	-	-	-	4
AN	<i>Syllis (Syllis) gracilis</i>	-	-	-	-	-	-	-	-	-	-	-	4	4
AR	<i>Caecognathia crenulatifrons</i>	-	-	-	-	-	-	1	-	-	1	1	1	4
AR	<i>Euphilomedes</i> sp	-	-	-	-	-	4	-	-	-	-	-	-	4
AR	<i>Hemicyclops thysanotus</i>	-	-	-	-	-	-	-	4	-	-	-	-	4
AR	Lysianassidae	-	-	-	-	4	-	-	-	-	-	-	-	4
AR	<i>Mandibulophoxus gilesi</i>	-	-	-	-	-	-	-	4	-	-	-	-	4
AR	<i>Xenoleberis californica</i>	-	3	-	-	-	1	-	-	-	-	-	-	4
MO	<i>Actaecina culcitella</i>	-	1	-	-	-	-	2	-	-	-	-	1	4
MO	<i>Cryptomya californica</i>	-	-	-	4	-	-	-	-	-	-	-	-	4
MO	<i>Ensis myrae</i>	-	-	-	-	1	1	2	-	-	-	-	-	4
MO	<i>Laevicardium substratum</i>	-	-	-	-	-	-	-	-	2	-	-	2	4
MO	<i>Nitidiscala sawiniae</i>	-	-	-	-	-	1	2	1	-	-	-	-	4
MO	Nudibranchia	-	-	-	4	-	-	-	-	-	-	-	-	4
MO	<i>Turbanilla</i> sp L MBC 1975	-	-	-	-	1	1	-	2	-	-	-	-	4
PL	<i>Pseudoceros</i> sp	-	-	-	-	1	-	2	-	-	-	-	1	4
AN	<i>Chaetozone</i> sp	3	-	-	-	-	-	-	-	-	-	-	-	3
AN	<i>Cirrophorus furcatus</i>	-	-	-	-	-	-	-	1	-	-	2	-	3
AN	<i>Diopatra tridentata</i>	-	-	-	-	-	-	-	-	-	-	-	3	3
AN	<i>Displo uncinata</i>	-	-	-	-	1	2	-	-	-	-	-	-	3
AN	<i>Efone californica</i>	-	-	-	-	-	-	-	-	-	3	-	-	3
AN	<i>Eupolynnia heterobranchia</i>	-	-	-	1	-	-	-	-	-	1	-	1	3
AN	<i>Exogone breviseta</i>	-	-	-	-	-	-	2	1	-	-	-	-	3
AN	<i>Heteropodarke heteromorpha</i>	-	-	-	-	-	-	-	1	2	-	-	-	3
AN	Onuphidae	-	-	1	1	-	-	-	-	-	-	-	1	3
AN	<i>Phyllodoce</i> sp	-	-	-	-	2	-	-	-	-	-	-	-	3
AN	<i>Polydora socialis</i>	-	-	-	-	-	-	-	-	-	-	-	-	3
AN	<i>Scoleloma</i> sp B (Harris 1985)	-	-	-	-	-	-	-	-	-	-	-	3	3
AN	<i>Sthenelais verruculosa</i>	-	-	-	-	-	-	-	-	-	2	-	1	3
AR	<i>Ampelisca</i> sp	-	-	1	-	1	-	1	-	-	-	-	-	3
AR	Ampithoidae	-	-	-	-	1	-	-	-	-	-	-	2	3
AR	<i>Cancer antennarius</i>	-	1	-	1	-	-	-	-	-	-	-	1	3
AR	Corophiidae	-	-	-	-	3	-	-	-	-	-	-	-	3
AR	Isaeidae	-	-	-	2	-	-	-	-	-	1	-	-	3
AR	<i>Photis</i> sp A MBC 1972	-	-	-	-	-	-	1	2	-	-	-	-	3
AR	Polynoidae	-	-	1	2	-	-	-	-	-	-	-	-	3
AR	<i>Rhepoxynius</i> sp	1	-	-	2	-	-	-	-	-	-	-	-	3
AR	<i>Rhepoxynius stenodes</i>	-	-	1	-	-	-	-	-	1	-	-	1	3
AR	<i>Siliophasma geminata</i>	-	-	-	-	2	1	-	-	-	-	-	-	3
CN	<i>Hydractinia</i> sp	-	-	-	-	-	-	-	-	-	-	-	3	3
CN	<i>Scolanthus</i> sp A SCAMIT 1983	-	-	-	-	-	1	-	-	1	-	-	1	3
CN	<i>Stylatula elongata</i>	-	1	1	-	-	-	-	-	-	-	-	1	3
CN	Virgulariidae	-	-	-	-	-	-	-	-	-	3	-	-	3
CO	<i>Branchiostoma californiense</i>	-	-	-	-	-	-	-	3	-	-	-	-	3
EC	<i>Astropecten armatus</i>	1	-	-	-	-	-	2	-	-	-	-	-	3
EP	<i>Amathia distans</i>	-	-	-	2	1	-	-	-	-	-	-	-	3
EP	<i>Zoobotryon verticillatum</i>	-	-	-	-	3	-	-	-	-	-	-	-	3
MO	<i>Alia carinata</i>	-	-	-	3	-	-	-	-	-	-	-	-	3
MO	<i>Compsomyax subdiaphana</i>	-	-	-	-	-	2	1	-	-	-	-	1	3
MO	<i>Philine auriformis</i>	-	-	-	-	2	1	-	-	-	-	-	-	3
MO	<i>Philine</i> sp	-	-	-	-	2	1	-	-	-	-	-	-	3
MO	<i>Trachycardium quadragenarium</i>	-	-	-	-	-	-	2	-	-	-	-	1	3
MO	<i>Turbanilla</i> sp	-	-	2	1	-	-	-	-	-	-	-	-	3
NE	<i>Micrura alaskensis</i>	-	-	-	3	-	-	-	-	-	-	-	-	3

Appendix G-5. (Cont.).

Phylum Species	Year												Total
	1988 W	1990 S	1991	1992	1993	1994	1997	1998	1999	2000	2001	Total	
SI <i>Apionsoma misakianum</i>	1	-	-	-	-	-	1	-	-	1	-	-	3
SI <i>Sipuncula</i>	-	2	-	-	-	-	-	-	-	1	-	-	3
AN <i>Anotomastus</i> sp	-	2	-	-	-	-	-	-	-	-	-	-	2
AN <i>Dipolydora commensalis</i>	-	-	-	-	2	-	-	-	-	-	-	-	2
AN <i>Dorvillea</i> sp	-	-	-	-	-	-	-	-	-	-	2	-	2
AN <i>Drilonereis</i> sp	-	-	1	-	-	-	-	-	-	1	-	-	2
AN <i>Eteone leptotes</i>	-	-	-	-	-	-	2	-	-	-	-	-	2
AN <i>Eteone pigmentata</i>	-	-	-	-	-	-	-	-	-	-	-	2	2
AN <i>Eusyllis</i> sp	-	1	-	-	-	-	-	-	-	-	1	-	2
AN <i>Exogone dwisula</i>	-	-	-	2	-	-	-	-	-	-	-	-	2
AN <i>Exogone molesta</i>	-	1	-	-	1	-	-	-	-	-	-	-	2
AN <i>Lumbrineris minima</i>	-	-	2	-	-	-	-	-	-	-	-	-	2
AN <i>Microspio pigmentata</i>	-	-	-	-	1	-	-	-	-	1	-	-	2
AN <i>Nephtys californiensis</i>	-	-	-	-	-	-	2	-	-	-	-	-	2
AN <i>Nereiphylla castanea</i>	-	-	-	-	-	-	-	1	-	1	-	-	2
AN <i>Notomastus lineatus</i>	-	-	-	-	-	-	2	-	-	-	-	-	2
AN <i>Paramage scutata</i>	-	-	-	-	-	-	-	-	-	2	-	-	2
AN <i>Phyllochaopterus prolifica</i>	-	-	-	-	-	-	1	-	1	-	-	-	2
AN <i>Pista agassizi</i>	-	-	-	-	-	-	-	-	1	-	1	-	2
AN <i>Polyopthalmus pictus</i>	-	-	-	-	-	-	-	-	-	-	2	-	2
AN <i>Salmacina tribranchiata</i>	-	-	-	2	-	-	-	-	-	-	-	-	2
AN <i>Scolelepis tridentata</i>	-	-	-	-	-	-	-	-	2	-	-	-	2
AN <i>Sigambla setosa</i>	-	-	-	-	-	-	-	-	-	-	-	2	2
AN <i>Sige</i> sp A SCAMIT 1995	-	-	2	-	-	-	-	-	-	-	-	-	2
AN <i>Spio maculata</i>	-	-	-	-	-	-	2	-	-	-	-	-	2
AN <i>Spionidae</i>	-	-	-	-	-	-	-	2	-	-	-	-	2
AN <i>Streblosoma crassibranchia</i>	-	-	-	-	-	-	-	-	-	-	1	1	2
AR <i>Ammothea hilgendorfi</i>	-	-	-	-	-	-	-	-	-	-	-	2	2
AR <i>Anomura</i>	-	-	-	-	-	-	-	-	-	-	-	2	2
AR <i>Anoplodactylus erectus</i>	-	-	-	2	-	-	-	-	-	-	-	-	2
AR <i>Atylus tridens</i>	-	-	-	2	-	-	-	-	-	-	-	-	2
AR <i>Cancer</i> sp	-	-	-	-	-	-	-	-	-	-	1	1	2
AR <i>Cumella vulgaris</i>	-	-	2	-	-	-	-	-	-	-	-	-	2
AR <i>Cytherella</i> sp A Myers 1975	-	-	-	-	-	-	-	-	-	2	-	-	2
AR <i>Foxiphalus obtusidens</i>	-	-	-	-	-	-	-	-	-	1	-	1	2
AR <i>Hippolytidae</i>	-	-	-	-	-	-	-	-	-	1	1	-	2
AR <i>Hippomedon zetesimus</i>	-	-	2	-	-	-	-	-	-	-	-	-	2
AR <i>Joeropsis dubia</i>	-	-	-	2	-	-	-	-	-	-	-	-	2
AR <i>Lepidepecreum</i> sp A SCAMIT 1985	-	-	1	1	-	-	-	-	-	-	-	-	2
AR <i>Listriella melanica</i>	-	-	-	-	1	-	-	-	-	1	-	-	2
AR <i>Neastacilla californica</i>	-	-	-	1	-	1	-	-	-	-	-	-	2
AR <i>Paguridae</i>	-	-	-	-	2	-	-	-	-	-	-	-	2
AR <i>Pinnixia tubicola</i>	2	-	-	-	-	-	-	-	-	-	-	-	2
AR <i>Pycnogonida</i>	1	-	-	1	-	-	-	-	-	-	-	-	2
AR <i>Rhepoxynius bicuspidatus</i>	-	-	2	-	-	-	-	-	-	-	-	-	2
AR <i>Rhepoxynius daboios</i>	-	-	-	2	-	-	-	-	-	-	-	-	2
CN <i>Actiniidae</i>	-	-	2	-	-	-	-	-	-	-	-	-	2
CN <i>Anthozoa</i>	-	-	2	-	-	-	-	-	-	-	-	-	2
CN <i>Cactosoma arenaria</i>	-	-	-	-	-	-	-	2	-	-	-	-	2
CN <i>Edwardsiidae</i>	-	1	-	-	1	-	-	-	-	-	-	-	2
EC <i>Amphiodia psara</i>	-	-	-	-	-	-	-	-	-	1	-	1	2
EC <i>Ophiactis simplex</i>	-	-	-	2	-	-	-	-	-	-	-	-	2
EP <i>Bowerbankia gracilis</i>	-	-	-	1	-	-	-	-	-	-	1	-	2
EP <i>Conopeum reticulum</i>	-	-	-	2	-	-	-	-	-	-	-	-	2
EP <i>Crisia occidentalis</i>	-	-	-	2	-	-	-	-	-	-	-	-	2
MO <i>Acteocina inculta</i>	-	1	-	-	1	-	-	-	-	-	-	-	2
MO <i>Bivalvia</i>	-	-	-	-	-	-	-	-	-	-	-	2	2
MO <i>Epitonium sawinae</i>	-	-	1	-	-	-	-	-	-	-	1	-	2
MO <i>Leptopecten latiauratus</i>	-	-	-	-	-	-	-	-	-	-	-	2	2
MO <i>Mactridae</i>	-	2	-	-	-	-	-	-	-	-	-	-	2
MO <i>Mytilidae</i>	-	-	-	-	-	-	2	-	-	-	-	-	2
MO <i>Mytilus</i> sp	-	-	-	2	-	-	-	-	-	-	-	-	2
MO <i>Nassarius fossatus</i>	-	-	-	-	-	-	2	-	-	-	-	-	2
MO <i>Polygireulima rutila</i>	-	-	2	-	-	-	-	-	-	-	-	-	2
MO <i>Tellina</i> sp B SCAMIT 1995	-	-	-	-	1	-	-	-	-	1	-	-	2
MO <i>Tellinidae</i>	-	-	-	-	-	-	2	-	-	-	-	-	2
MO <i>Thracia curta</i>	-	-	-	-	-	-	-	2	-	-	-	-	2
MO <i>Thyasira flexuosa</i>	-	-	-	-	-	-	-	-	-	-	1	1	2
MO <i>Turbonilla</i> sp F MBC 1971	-	-	-	-	-	-	-	2	-	-	-	-	2
MO <i>Turbonilla</i> sp N MBC 1980	-	-	-	-	1	-	-	-	-	-	-	-	2
MO <i>Turbonilla</i> sp S MBC 1993	-	-	-	-	-	2	-	-	-	-	-	-	2
NE <i>Monostylifera</i> sp C SCAMIT 1995	-	-	-	-	-	-	-	2	-	-	-	-	2
NE <i>Monostylifera</i> sp SD1 Pt. Loma 1995	-	-	-	-	-	-	-	-	-	-	-	2	2
AN <i>Ancistrosyllis groenlandica</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
AN <i>Ancistrosyllis hamata</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AN <i>Annelida</i>	-	-	-	-	-	-	-	-	-	-	-	1	1
AN <i>Anobothrus gracilis</i>	-	-	-	-	-	-	-	-	-	1	-	-	1
AN <i>Aphelochaeta</i> sp	-	-	-	-	-	-	-	-	1	-	-	-	1

Appendix G-5. (Cont.).

Phylum Species	Year												Total
	1988 W	1988 S	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	
AN <i>Arabella incolor</i>	-	-	-	-	-	-	-	-	-	1	-	-	1
AN <i>Arctoobia cf anticostiensis</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AN <i>Autolytinae</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AN <i>Boccardia basilaria</i>	-	-	-	-	-	-	-	-	-	1	-	-	1
AN <i>Caulieriella pacifica</i>	-	-	-	-	-	-	-	-	1	-	-	-	1
AN <i>Cheiloneurus cyclurus</i>	-	-	-	-	-	-	-	-	-	1	-	-	1
AN <i>Chone sp C Harris 1984</i>	-	-	-	-	-	-	-	-	-	1	-	-	1
AN <i>Cirrophorus spp</i>	1	-	-	-	-	-	-	-	-	-	-	-	1
AN <i>Clavodorum sp</i>	-	-	-	1	-	-	-	-	-	-	-	-	1
AN <i>Demonax sp</i>	-	-	-	-	-	-	-	-	-	1	-	-	1
AN <i>Demonax sp 1 Fitzhugh 1993</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AN <i>Eteone sp</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
AN <i>Eulalia levicornuta</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AN <i>Genetyllis castanea</i>	-	-	-	-	-	-	1	-	-	-	-	-	1
AN <i>Grubeulepis mexicana</i>	-	-	-	-	-	-	-	-	1	-	-	-	1
AN <i>Halosydna johnsoni</i>	-	-	-	-	-	-	-	-	-	1	-	-	1
AN <i>Loimia sp A SCAMIT 2001</i>	-	-	-	1	-	-	-	-	-	-	-	-	1
AN <i>Lumbrineris cruzensis</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
AN <i>Microphtalmus hystrix</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AN <i>Micropodarke dubia</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AN <i>Microspio spinosa</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AN <i>Myxicola infundibulum</i>	-	-	1	-	-	-	-	-	-	-	-	-	1
AN <i>Nephys ferruginea</i>	-	-	1	-	-	-	-	-	-	-	-	-	1
AN <i>Nothria sp</i>	-	1	-	-	-	-	-	-	-	-	-	-	1
AN <i>Notocirrus californiensis</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AN <i>Odontosyllis phosphorea</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AN <i>Paraonidae</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AN <i>Pherusa capulata</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AN <i>Pholoe glabra</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AN <i>Phylodocidae</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AN <i>Pilargis maculata</i>	-	-	-	-	-	-	1	-	-	-	-	-	1
AN <i>Pista sp</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AN <i>Polycirrus sp A SCAMIT 1995</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AN <i>Polydora sp</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
AN <i>Scoloplos acmeceps</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AN <i>Sigalionidae</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AN <i>Sphaerophesia similisetis</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AN <i>Sthenelais berkeleyi</i>	-	1	-	-	-	-	-	-	-	-	-	-	1
AN <i>Sthenelais fusca</i>	-	-	-	-	-	-	-	-	-	1	-	-	1
AN <i>Trypanosyllis sp</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AR <i>Achelia sp</i>	-	-	-	1	-	-	-	-	-	-	-	-	1
AR <i>Ampelisca careyi</i>	-	-	1	-	-	-	-	-	-	-	-	-	1
AR <i>Anchicolarus occidentalis</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AR <i>Anomura, megalopa</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AR <i>Brachyura</i>	-	-	-	-	-	-	-	-	-	-	-	1	1
AR <i>Brachyura, zoea</i>	-	-	-	-	-	-	-	-	1	-	-	-	1
AR <i>Campylaspis hartae</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AR <i>Campylaspis sp C SCAMIT 1986</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AR <i>Cancer anthonyi</i>	-	-	-	1	-	-	-	-	-	-	-	-	1
AR <i>Caprella sp</i>	-	-	-	-	-	-	-	-	-	-	-	1	1
AR <i>Cumacea</i>	-	-	-	-	-	-	1	-	-	-	-	-	1
AR <i>Cumella sp K MBC 1993</i>	-	-	-	-	-	-	1	-	-	-	-	-	1
AR <i>Cyclaspis sp B SCAMIT 1989</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AR <i>Cytheridae</i>	-	-	-	-	-	-	-	-	-	-	-	1	1
AR <i>Eochelidium sp A SCAMIT 1996</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AR <i>Eusiridae</i>	-	-	-	1	-	-	-	-	-	-	-	-	1
AR <i>Fabia subquadrata</i>	-	-	-	-	-	-	1	-	-	-	-	-	1
AR <i>Laticorophium baconi</i>	-	-	-	-	-	-	1	-	-	-	-	-	1
AR <i>Lepidopa californica</i>	-	-	-	1	-	-	-	-	-	-	-	-	1
AR <i>Listriella eriopisa</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
AR <i>Majidae</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AR <i>Melphidippidae</i>	-	-	-	-	1	-	-	-	-	-	-	-	1
AR <i>Nebalia daytoni</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
AR <i>Nebalia puggettensis cmplx</i>	1	-	-	-	-	-	-	-	-	-	-	-	1
AR <i>Photis sp OC1 Diener 1992</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
AR <i>Pinnixia littoralis</i>	-	-	-	-	-	-	1	-	-	-	-	-	1
AR <i>Porcellanidae, megalopa</i>	-	-	-	-	-	-	-	-	1	-	-	-	1
AR <i>Rhepoxynius abronius</i>	-	1	-	-	-	-	-	-	-	-	-	-	1
AR <i>Tanystylum californicum</i>	-	-	-	-	-	-	-	-	-	-	-	1	1
AR <i>Tiron biocellata</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
AR <i>Tritella laevis</i>	1	-	-	-	-	-	-	-	-	-	-	-	1
CN <i>Ceriantharia</i>	-	-	-	-	1	-	-	-	-	-	-	-	1
CN <i>Clytia universitatis</i>	-	-	-	-	1	-	-	-	-	-	-	-	1
CN <i>Coryne corrugata</i>	-	-	-	-	1	-	-	-	-	-	-	-	1
CN <i>Lovenella nodosa</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
CN <i>Obelia sp A MEC 1990</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
CN <i>Pennatulacea</i>	-	-	-	-	-	-	-	-	1	-	-	-	1
CN <i>Stylectis sp</i>	-	-	-	-	-	-	-	-	-	-	1	-	1

Appendix G-5. (Cont.).

Phylum Species	Year												
	1988 W	1990 S	1991	1992	1993	1994	1997	1998	1999	2000	2001	Total	
CN <i>Virgularia californica</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
CN <i>Virgularia</i> sp	-	-	-	1	-	-	-	-	-	-	-	-	1
CO <i>Ilypnus gilberti</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
EC <i>Amphioplus</i> sp LA1 1999	-	-	-	-	-	-	1	-	-	-	-	-	1
EC <i>Amphioplus strongyloplax</i>	-	-	-	-	-	-	-	-	-	1	-	-	1
EC <i>Amphiura</i> sp	-	-	1	-	-	-	-	-	-	-	-	-	1
EC <i>Lovenia cordiformis</i>	-	-	-	-	-	-	-	-	1	-	-	-	1
EC <i>Pentameria</i> sp	-	-	-	-	-	-	1	-	-	-	-	-	1
EP <i>Bugula neritina</i>	-	-	-	1	-	-	-	-	-	-	-	-	1
EP <i>Jellyella tuberculata</i>	-	-	-	1	-	-	-	-	-	-	-	-	1
MO <i>Aeolidioida</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
MO <i>Aphysiidae</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
MO <i>Axinopsida serricata</i>	-	-	1	-	-	-	-	-	-	-	-	-	1
MO <i>Balcis</i> sp	-	-	-	1	-	-	-	-	-	-	-	-	1
MO <i>Crenella decussata</i>	1	-	-	-	-	-	-	-	-	-	-	-	1
MO <i>Crepidula glottidiarum</i>	-	-	1	-	-	-	-	-	-	-	-	-	1
MO <i>Crepidula onyx</i>	-	-	-	-	-	-	-	-	1	-	-	-	1
MO <i>Crucibulum spinosum</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
MO <i>Ennucula tenuis</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
MO <i>Epitonium californica</i>	1	-	-	-	-	-	-	-	-	-	-	-	1
MO <i>Gari edentula</i>	-	-	1	-	-	-	-	-	-	-	-	-	1
MO <i>Gastropoda</i>	-	1	-	-	-	-	-	-	-	-	-	-	1
MO <i>Haminoea virescens</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
MO <i>Lucinisa nuttalli</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
MO <i>Macoma indentata</i>	-	-	-	-	-	-	1	-	-	-	-	-	1
MO <i>Macoma secta</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
MO <i>Mysella</i> sp	-	-	-	-	-	1	-	-	-	-	-	-	1
MO <i>Mysella</i> sp C SCAMIT 1988	-	1	-	-	-	-	-	-	-	-	-	-	1
MO <i>Nassarius</i> sp	-	1	-	-	-	-	-	-	-	-	-	-	1
MO <i>Nuttallia nuttallii</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
MO <i>Odostomia farella</i>	-	-	-	-	1	-	-	-	-	-	-	-	1
MO <i>Petricola carditoides</i>	-	-	-	-	-	-	-	-	-	-	-	1	1
MO <i>Rhamphidonta retifera</i>	-	-	1	-	-	-	-	-	-	-	-	-	1
MO <i>Saxidomus nuttalli</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
MO <i>Tellina idae</i>	-	-	-	-	-	-	-	-	1	-	-	-	1
MO <i>Turbanilla nuttingi</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
MO <i>Turbanilla</i> sp C MBC 1971	-	-	-	-	1	-	-	-	-	-	-	-	1
MO <i>Turbanilla</i> sp D MBC 1971	-	-	-	-	1	-	-	-	-	-	-	-	1
MO <i>Volvulella cylindrica</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
MO <i>Yoldia scissurata</i>	-	1	-	-	-	-	-	-	-	-	-	-	1
NE <i>Amphiporus bimaculatus</i>	-	-	-	-	-	-	-	-	-	-	-	1	1
NE <i>Amphiporus fulvus</i>	-	-	-	-	-	-	-	1	-	-	-	-	1
NE <i>Hoplonemertea</i> sp B MEC 1988	-	-	-	-	-	-	-	-	-	-	-	1	1
NE <i>Lineus bilineatus</i>	-	-	-	1	-	-	-	-	-	-	-	-	1
NE <i>Tubulanus cingulatus</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
NE <i>Zygonemertes virescens</i>	-	-	-	-	-	-	-	-	-	-	-	1	1
PL <i>Eurylepta</i> sp	-	-	-	-	-	-	-	-	-	-	-	-	1
PL <i>Kaburakia excelsa</i>	-	1	-	-	-	-	-	-	-	-	-	-	1
PL <i>Parviplana californica</i>	-	-	-	-	-	-	1	-	-	-	-	-	1
PL <i>Platyhelminthes</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
PR <i>Phoronopsis harmeri</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
SI <i>Golfingiidae</i>	-	-	1	-	-	-	-	-	-	-	-	-	1
Number of individuals	363	588	1179	2592	2705	2295	3719	5195	2133	1960	3463	25151	22729
Number of species	80	115	145	187	192	191	213	234	120	184	209	260	1661
Diversity (H')	3.33	3.99	3.68	3.46	3.71	3.96	3.88	3.64	3.11	4.08	3.40	1.76	
Total biomass (g)	1884.8	12949.2	16.88	24.51	19.62	16.26	22.87	12.87	12.12	49.28	33.28	42.78	
Number of stations/reps	5/4	5/4	9/4	9/4	9/4 *	9/4	9/4	9/4	4/4	9/4	9/4	12/4	

* Four replicates were analyzed at all stations except Station B9 where three samples were analyzed.

APPENDIX H

Fish and macroinvertebrate trawl data by station

Appendix H-1. Master species list of fish and macroinvertebrate species taken by otter trawl. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

PHYLUM Class Family Species	Common Name	PHYLUM Class Family Species	Common Name
ARTHROPODA		CNIDARIA	
Malacostraca		Anthozoa	
Cancridae		Renillidae	
<i>Cancer gracilis</i>	graceful rock crab	<i>Renilla kollikeri</i>	sea pansy
<i>Cancer anthonyi</i>	yellow crab		
Crangonidae			
<i>Crangon nigromaculata</i>	blackspotted bay shrimp	CHORDATA	
Diogenidae		Elasmobranchiomorphi (=Chondrichthys, Elasmobranchii)	
<i>Isocheles pilosus</i>	moon snail hermit crab	Myliobatidae	
<i>Isocheles sp</i>	hermit crab	<i>Myliobatis californica</i>	bat ray
Hippolytidae		Urolophidae	
<i>Heptacarpus palpator</i>	intertidal coastal shrimp	<i>Urolophus halleri</i>	round stingray
Leucosiidae			
<i>Randalia ornata</i>	globose sand crab	Osteichthyes (=Actinopterygii)	
Majidae		Batrachoididae	
<i>Pyromais tuberculata</i>	tuberculate pear crab	<i>Porichthys notatus</i>	plainfin midshipman
<i>Loxorhynchus crispatus</i>	masking crab	Bothidae	
Paniluridae		<i>Xystreurus liolepis</i>	
<i>Panulirus interruptus</i>	California spiny lobster	Cottidae	
Penaeidae		<i>Leptocottus armatus</i>	
<i>Farfantepenaeus californiensis</i>	yellowleg shrimp	Cynoglossidae	
Porcellanidae		<i>Symphurus atricauda</i>	
<i>Pachycheles pubescens</i>	pubescent porcelain crab	Embiotocidae	
Portunidae		<i>Cymatogaster aggregata</i>	
<i>Portunus xantusii</i>	xantus swimming crab	<i>Phanerodon furcatus</i>	shiner perch
		<i>Embiotoca jacksoni</i>	white seaperch
		<i>Hyperprosopon agenteum</i>	black perch
		Engraulidae	walleye surperch
		<i>Anchoa compressa</i>	
		<i>Engraulis mordax</i>	deepbody anchovy
ECHINODERMATA		Gobiidae	northern anchovy
Asteroidea		<i>Lepidogobius lepidus</i>	
Astropectinidae		Pleuronectidae	
<i>Astropecten armatus</i>	spiny sand star	<i>Hypsopsetta guttulata</i>	bay goby
Asteriidae		<i>Pleuronichthys ritteri</i>	
<i>Pisaster brevispinus</i>	short-spined seastar	<i>Pleuronichthys verticalis</i>	
Ophiuroidea		Paralichthyidae	
<i>Ophiothrix spiculata</i>	spiny brittle star	<i>Citharichthys stigmaeus</i>	
Echinoidea		<i>Paralichthys californicus</i>	
Toxopneustidae	white sea urchin	Sciaenidae	
<i>Lytechinus pictus</i>		<i>Genyonemus lineatus</i>	
MOLLUSCA		<i>Menticirrhus undulatus</i>	
Gastropoda		<i>Umbrina roncador</i>	
Flabellinidae		<i>Seriphus politus</i>	
<i>Flabellina iodinea</i>	purple aeolis	Scorpaenidae	
Philinidae		<i>Scorpaena guttata</i>	
<i>Philine auriformis</i>	tortellini snail	Serranidae	
Nassariidae		<i>Paralabrax nebulifer</i>	
<i>Nassarius perpinguis</i>	fat western nassa	Stromateidae	
Naticidae		<i>Peprilus simillimus</i>	
<i>Neverita reclusiana</i>	Southern moonsnail	Syngnathidae	
Arminidae		<i>Syngnathus californiensis</i>	
<i>Armina californica</i>	California armina	Synodontidae	
Bivalvia		<i>Synodus lucioceps</i>	
Chlamydoconchidae	Orcutt nakedclam		
<i>Chlamydoconcha orcutti</i>			
Limidae			
<i>Limaria hemphilli</i>	Hemphill fileclam		

Appendix H-2. Abundance of fish species in trawl replicates. Haynes and AES Alamitos L.L.C. generating stations NPDES, winter 2001.

Species	Station-Replicate												Percent				
	T1-I	T1-II	T2-I	T2-II	T3-I	T3-II	T4-I	T4-II	T5-I	T5-II	T6-I	T6-II	Total	Total	Mean	S.D.	
<i>Genyonemus lineatus</i> *	-	1	35	123	29	73	8	3	26	12	12	46	368	51.54	30.7	36.2	
<i>Citharichthys stigmaeus</i>	6	7	6	6	1	3	33	7	12	6	4	12	103	14.43	8.6	8.3	
<i>Seriphus politus</i>	-	-	-	28	17	29	-	-	-	-	20	8	102	14.29	8.5	11.7	
<i>Syphurus atricauda</i>	-	-	-	-	-	-	30	1	1	-	-	-	32	4.48	2.7	8.6	
<i>Paralichthys californicus</i>	-	1	3	1	1	2	2	1	5	4	2	2	24	3.36	2.0	1.4	
<i>Pleuronichthys ritteri</i>	2	1	-	-	-	1	2	3	9	2	1	3	24	3.36	2.0	2.4	
<i>Engraulis mordax</i> *	-	-	-	5	8	2	1	-	-	-	-	-	16	2.24	1.3	2.6	
<i>Phanerodon furcatus</i>	-	-	-	-	-	1	-	4	-	1	-	-	6	0.84	0.5	1.2	
<i>Syngnathus californiensis</i>	-	-	3	2	-	-	-	-	-	-	-	1	6	0.84	0.5	1.0	
<i>Urolophus helleri</i>	-	-	-	-	-	4	1	-	-	-	-	-	5	0.70	0.4	1.2	
<i>Hypsopsetta guttulata</i>	1	-	1	1	-	-	-	-	1	-	-	-	4	0.56	0.3	0.5	
<i>Menticirrhus undulatus</i>	-	-	1	-	-	2	-	-	-	1	-	-	4	0.56	0.3	0.7	
<i>Umbrina roreadora</i>	-	-	-	-	-	3	-	-	-	-	1	-	4	0.56	0.3	0.9	
<i>Xystreurus liolepis</i>	-	-	-	-	1	1	1	-	1	-	-	-	4	0.56	0.3	0.5	
<i>Paralebrax nebulifer</i>	-	-	-	-	1	-	-	-	1	1	-	-	3	0.42	0.3	0.5	
<i>Embiotoca jacksoni</i>	-	-	-	-	-	-	-	1	-	-	1	-	2	0.28	0.2	0.4	
<i>Lepidogobius lepidus</i>	-	-	-	-	-	-	1	-	-	1	-	-	2	0.28	0.2	0.4	
<i>Anchoa compressa</i>	-	-	-	-	-	1	-	-	-	-	-	-	1	0.14	0.1	0.3	
<i>Cymatogaster aggregata</i>	-	-	-	-	-	-	-	-	-	-	1	-	1	0.14	0.1	0.3	
<i>Hyperprosopon agenteum</i>	-	-	-	-	1	-	-	-	-	-	-	-	1	0.14	0.1	0.3	
<i>Myliobatis californica</i>	-	-	-	1	-	-	-	-	-	-	-	-	1	0.14	0.1	0.3	
<i>Pleuronichthys verticalis</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.14	0.1	0.3	
Station Totals																	
Individuals	19		216		181		100		84		114		714		119.0		70.5
Species	5		9		14		12		11		9		22		10.0		3.1
Diversity (H')	1.59		1.43		1.94		1.98		2.17		1.89		1.68		1.83		0.27

*Under 30 mm standard length:

<i>Engraulis mordax</i>	-	-	-	-	2	-	-	-	3	15	3	-	23			
<i>Genyonemus lineatus</i>	-	-	6	104	16	20	2	10	76	35	20	-	289			

Appendix H-3. Abundance of fish species in trawl replicates. Haynes and AES Alamitos L.L.C. generating stations NPDES, summer 2001.

Species	Station-Replicate												Percent				
	T1-I	T1-II	T2-I	T2-II	T3-I	T3-II	T4-I	T4-II	T5-I	T5-II	T6-I	T6-II	Total	Total	Mean	S.D.	
<i>Synodus lucioceps</i>	-	-	3	-	8	9	-	4	3	1	2	10	40	26.32	3.3	3.7	
<i>Genyonemus lineatus</i>	2	-	-	-	-	1	6	22	-	-	-	-	31	20.39	2.6	6.4	
<i>Paralichthys californicus</i>	1	1	2	3	1	-	-	1	2	1	3	-	15	9.87	1.3	1.1	
<i>Peprius simillimus</i>	-	-	-	-	-	-	12	-	-	-	-	-	12	7.89	1.0	3.5	
<i>Citharichthys stigmaeus</i>	-	-	-	-	2	-	3	1	2	-	3	-	11	7.24	0.9	1.2	
<i>Cymatogaster aggregata</i>	-	-	-	-	-	-	1	8	-	-	-	-	9	5.92	0.8	2.3	
<i>Phanerodon furcatus</i>	-	-	-	-	-	-	-	7	2	-	-	-	9	5.92	0.8	2.1	
<i>Engraulis mordax</i>	-	-	-	-	-	-	7	-	-	-	-	-	7	4.61	0.6	2.0	
<i>Syphurus atricauda</i>	-	-	-	-	-	-	1	5	-	-	-	-	6	3.95	0.5	1.4	
<i>Pleuronichthys ritteri</i>	-	-	-	-	1	1	1	-	-	-	-	-	3	1.97	0.3	0.5	
<i>Paralebrax nebulifer</i>	-	-	1	-	-	-	-	-	-	-	1	-	2	1.32	0.2	0.4	
<i>Porichthys notatus</i>	-	-	-	-	-	-	-	2	-	-	-	-	2	1.32	0.2	0.6	
<i>Hypsopsetta guttulata</i>	-	-	-	-	1	-	-	-	-	-	-	-	1	0.66	0.1	0.3	
<i>Leptocottus armatus</i>	-	-	-	-	1	-	-	-	-	-	-	-	1	0.66	0.1	0.3	
<i>Myliobatis californica</i>	-	-	-	-	-	-	-	1	-	-	-	-	1	0.66	0.1	0.3	
<i>Scorpaena guttata</i>	-	-	-	-	-	-	-	1	-	-	-	-	1	0.66	0.1	0.3	
<i>Seriphus politus</i>	-	-	-	-	-	1	-	-	-	-	-	-	1	0.66	0.1	0.3	
Station Totals																	
Individuals	4		9		25		84		11		19		152		25.3		29.7
Species	2		3		7		14		4		4		17		5.7		4.4
Diversity (H')	1.04		1.31		1.71		2.40		1.72		1.31		2.26		1.58		0.48

Under 30 mm standard length:

<i>Engraulis mordax</i>	2	-	-	1	-	2	2	23	-	-	1	-	31			
<i>Seriphus politus</i>	165	-	-	1	-	-	26	-	-	-	-	-	192			

Appendix H-4. Biomass (kg) of fish species in trawl replicates. Haynes and AES Alamitos L.L.C. generating stations NPDES, winter 2001.

Species	Station-Replicate												Percent			
	T1-I	T1-II	T2-I	T2-II	T3-I	T3-II	T4-I	T4-II	T5-I	T5-II	T6-I	T6-II	Total	Total	Mean	S.D.
<i>Genyonemus lineatus</i> *	-	0.043	0.620	0.985	0.691	1.350	0.010	0.005	1.560	0.826	0.706	1.802	8.598	31.48	0.717	0.629
<i>Paralichthys californicus</i>	-	0.055	0.242	0.236	0.750	0.170	1.067	0.574	1.140	2.091	0.102	0.113	6.540	23.95	0.545	0.626
<i>Seriphus politus</i>	-	-	-	0.610	0.514	1.015	-	-	-	-	0.785	0.242	3.166	11.59	0.264	0.370
<i>Pleuronichthys ritteri</i>	0.012	0.004	-	-	0.059	0.041	0.328	0.920	0.175	0.098	0.287	-	1.924	7.05	0.160	0.265
<i>Myliobatis californica</i>	-	-	-	1.850	-	-	-	-	-	-	-	-	1.850	6.77	0.154	0.534
<i>Urophorus halleri</i>	-	-	-	-	-	0.705	0.571	-	-	-	-	-	1.276	4.67	0.106	0.250
<i>Citharichthys stigmaeus</i>	0.055	0.052	0.057	0.062	0.024	0.014	0.152	0.040	0.096	0.054	0.033	0.125	0.764	2.80	0.064	0.041
<i>Xystreurus liolepis</i>	-	-	-	-	0.265	0.203	0.147	-	0.134	-	-	-	0.749	2.74	0.062	0.097
<i>Paralabrax nebulifer</i>	-	-	-	-	0.259	-	-	-	0.117	0.167	-	-	0.543	1.99	0.045	0.087
<i>Hypsopsetta guttulata</i>	0.165	-	0.109	0.076	-	-	-	-	0.161	-	-	-	0.511	1.87	0.043	0.067
<i>Phanerodon furcatus</i>	-	-	-	-	-	0.029	-	0.290	-	0.115	-	-	0.434	1.59	0.039	0.090
<i>Menticirrhus undulatus</i>	-	-	0.026	-	-	0.219	-	-	-	0.187	-	-	0.432	1.58	0.036	0.079
<i>Embiotoca jacksoni</i>	-	-	-	-	-	-	0.115	-	-	-	0.065	-	0.180	0.66	0.015	0.037
<i>Syphurus atricauda</i>	-	-	-	-	-	-	0.068	0.020	0.010	-	-	-	0.098	0.36	0.008	0.020
<i>Umbrina ronchador</i>	-	-	-	-	-	0.068	-	-	-	-	0.029	-	0.097	0.36	0.008	0.021
<i>Pleuronichthys verticalis</i>	-	-	-	-	-	-	0.049	-	-	-	-	-	0.049	0.18	0.004	0.014
<i>Hyperprosopon agenteum</i>	-	-	-	-	0.036	-	-	-	-	-	-	-	0.036	0.13	0.003	0.010
<i>Cymatogaster aggregata</i>	-	-	-	-	-	-	-	-	-	-	0.032	-	0.032	0.12	0.003	0.009
<i>Anchoa compressa</i>	-	-	-	-	-	0.011	-	-	-	-	-	-	0.011	0.04	0.001	0.003
<i>Engraulis mordax</i> *	-	-	-	0.001	0.005	0.002	0.002	-	-	-	-	-	0.010	0.04	0.001	0.002
<i>Syngnathus californiensis</i>	-	-	0.004	0.002	-	-	-	-	-	-	-	0.002	0.008	0.03	0.001	0.001
<i>Lepidogobius lepidus</i>	-	-	-	-	-	0.001	-	-	0.001	-	-	-	0.002	0.01	0.000	0.000
Station Totals																
Biomass	0.386	4.880	6.389	3.479	7.753	4.421							27.310	4.551	2.540	

*Under 30 mm standard length:

<i>Engraulis mordax</i>	-	-	0.001	-	-	0.001	0.001	0.001	0.001	0.001	-	-	0.004
<i>Genyonemus lineatus</i>	-	-	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-	0.009

Note: 0.000 = <0.0005

Appendix H-5. Biomass (kg) of fish species in trawl replicates. Haynes and AES Alamitos L.L.C. generating stations NPDES, summer 2001.

Species	Station-Replicate												Percent			
	T1-I	T1-II	T2-I	T2-II	T3-I	T3-II	T4-I	T4-II	T5-I	T5-II	T6-I	T6-II	Total	Total	Mean	S.D.
<i>Paralichthys californicus</i>	0.061	0.028	0.855	0.877	0.370	-	-	0.408	2.260	0.278	1.130	-	6.267	37.60	0.522	0.674
<i>Genyonemus lineatus</i>	0.149	-	-	-	-	0.082	0.753	2.960	-	-	-	-	3.944	23.66	0.329	0.856
<i>Myliobatis californica</i>	-	-	-	-	-	-	-	1.685	-	-	-	-	1.685	10.11	0.140	0.486
<i>Synodus lucioceps</i>	-	-	0.100	-	0.353	0.320	-	0.141	0.094	0.041	0.051	0.295	1.395	8.37	0.116	0.133
<i>Phanerodon furcatus</i>	-	-	-	-	-	-	-	0.907	0.302	-	-	-	1.209	7.25	0.101	0.268
<i>Scorpaena guttata</i>	-	-	-	-	-	-	-	0.381	-	-	-	-	0.381	2.29	0.032	0.110
<i>Peprius similimus</i>	-	-	-	-	-	-	0.360	-	-	-	-	-	0.360	2.16	0.030	0.104
<i>Pleuronichthys ritteri</i>	-	-	-	-	0.175	0.078	0.089	-	-	-	-	-	0.342	2.05	0.029	0.056
<i>Paralabrax nebulifer</i>	-	-	0.226	-	-	-	-	-	-	-	0.097	-	0.323	1.94	0.027	0.069
<i>Hypsopsetta guttulata</i>	-	-	-	-	0.181	-	-	-	-	-	-	-	0.181	1.09	0.015	0.052
<i>Cymatogaster aggregata</i>	-	-	-	-	-	-	0.008	0.162	-	-	-	-	0.170	1.02	0.014	0.047
<i>Syphurus atricauda</i>	-	-	-	-	-	-	0.007	0.098	-	-	-	-	0.105	0.63	0.009	0.028
<i>Porichthys notatus</i>	-	-	-	-	-	-	-	0.101	-	-	-	-	0.101	0.61	0.008	0.029
<i>Citharichthys stigmaeus</i>	-	-	-	-	0.033	-	0.020	0.018	0.007	-	0.010	-	0.088	0.53	0.007	0.011
<i>Seriphus politus</i>	-	-	-	-	-	-	0.055	-	-	-	-	-	0.055	0.33	0.005	0.016
<i>Leptocottus armatus</i>	-	-	-	-	-	0.043	-	-	-	-	-	-	0.043	0.26	0.004	0.012
<i>Engraulis mordax</i>	-	-	-	-	-	-	0.019	-	-	-	-	-	0.019	0.11	0.002	0.005
Station Totals																
Biomass	0.238	2.058	1.635	8.172	2.982	1.583							16.668	2.778	2.787	

Appendix H-6. Lengths of fish species in trawl replicates. Haynes and AES Alamitos L.L.C. generating stations NPDES, winter 2001.

Species	Sta-Rep	Length (mm)																											
<i>Anchoa compressa</i>		T3-II	121																										
<i>Citharichthys stigmaeus</i>		T1-I	81	86	86	78	94	102																					
		T1-II	91	92	87	84	79	92	80																				
		T2-I	88	85	84	82	119	31																					
		T2-II	91	84	93	98	87	91																					
		T3-I	91																										
		T3-II	90	78	92																								
		T4-I	45	32	68	67	80	75	46	31	77	75	73	50	35	78	45												
			33	41	75	88	75	32	68	75	72	73																	
		T4-II	76	88	67	69	72	72																					
		T5-I	85	97	70	77	87	86	70	87	93	82	87	98															
		T5-II	75	87	81	87	77	73																					
		T6-I	91	86	78	83																							
		T6-II	85	84	85	87	90	94	74	95	98	89	84	30															
<i>Cymatogaster aggregata</i>		T6-I	103																										
<i>Embiotoca jacksoni</i>		T4-II	154																										
		T6-I	126																										
<i>Engraulis mordax*</i>		T2-II	38	32	44	36	41																						
		T3-I	62	61	31	58	48	44	36	34																			
		T3-II	35	39																									
		T4-I	48																										
<i>Genyonemus lineatus*</i>		T1-II	142																										
		T2-I	186	191	149	83	117	44	46	139	74	61	34	56	72	51	53	41	33	44	44	35							
			41	38	46	169	76	49	84	43	47	51	52	79	157	46	33												
		T2-II	169	145	168	166	134	147	84	93	99	46	45	47	43	118	104	52	51	44	83	82							
			39	102	72	46	59	48	41	43	71	51	58	40	41	49	54	43	47	41	48	41							
			42	40	51	47	45	44	46	131	59	86	49	37	41	44	58	47	46	49	41	44							
			61	47	44	41	34	35	41	72	76	76	54	49	41	45	59	46	94	59	83	39							
			42	31	41	49	39	42	42	44	53	54	47	44	39	44	94	121	95	88	76	91							
			73	30	35	47	41	36	76	36	55	39	81	42	81	54	89	62	45	49	31	38							
			42	31	38																								
		T3-I	161	153	171	55	52	48	56	41	52	43	34	39	33	40	55	39	39	31	35	37							
			85	191	159	136	83	188	31	30	133																		
		T3-II	93	165	153	40	121	160	46	86	49	38	51	43	36	31	39	30	52	35	39	42							
			35	143	33	46	38	37	34	38	135	146	162	169	153	162	141	163	162	144	156	171							
			194	93	94	46	123	36	64	42	39	44	53	53	41	46	31	31	32	38	41	35							
			35	48	36	37	41	38	49	46	41	38	47	46	35														
		T4-I	38	42	49	38	42	51	36	43																			
		T4-II	51	38	42																								
		T5-I	142	148	156	180	137	116	118	133	173	165	168	151	159	136	135	137	157	94	72	105							
			173	179	117	116	121	117																					
		T5-II	187	187	207	142	148	153	158	92	136	95	116	162															
		T6-I	145	171	146	183	132	159	92	154	123	91	160	124															
		T6-II	139	132	172	131	177	125	169	86	178	60	188	162	180	92	133	146	45	163	116	121							
			105	154	161	106	129	130	85	151	102	140	130	140	110	101	99	94	86	111	119	104							
			83	137	72	86	78	53																					
<i>Hyperprosopon agenteum</i>		T3-I	118																										
<i>Hypsopsetta guttulata</i>		T1-I	202																										
		T2-I	183																										
		T2-II	176																										
		T5-I	178																										
<i>Lepidogobius lepidus</i>		T4-I	28																										
		T5-II	34																										

Appendix H-6. (Cont.).

Species	Sta-Rep	Length (mm)																			
<i>Menticirrhus undulatus</i>																					
T2-I	142																				
T3-II	215	166																			
T5-II	257																				
<i>Myliobatis californica</i>																					
T2-II	DW	480																			
	TL	717																			
<i>Paralabrax nebulifer</i>																					
T3-I	217																				
T5-I	169																				
T5-II	210																				
<i>Paralichthys californicus</i>																					
T1-II	171																				
T2-I	236	179	123																		
T2-II	282																				
T3-I	373																				
T3-II	229	161																			
T4-I	395	190																			
T4-II	342																				
T5-I	262	166	287	288	173																
T5-II	448	287	280	279																	
T6-I	170	162																			
T6-II	158	175																			
<i>Phanerodon furcatus</i>																					
T3-II	128																				
T4-II	135	130	187	175																	
T5-II	183																				
<i>Pleuronichthys ritteri</i>																					
T1-I	79	77																			
T1-II	76																				
T3-II	136																				
T4-I	185	197																			
T4-II	167	159	145																		
T5-I	162	150	170	159	157	137	183	130	151												
T5-II	162	177																			
T6-I	152																				
T6-II	160	153	168																		
<i>Pleuronichthys verticalis</i>																					
T4-I	120																				
<i>Seriphis politus</i>																					
T2-II	129	143	122	131	136	134	135	134	131	131	124	133	132	136	126	135	105	61	132	69	
	124	59	73	68	56	59	64	60													
T3-I	144	66	142	133	64	134	155	129	148	124	131	136	133	132	61	55	134				
T3-II	159	138	129	151	162	166	124	159	151	132	86	161	139	152	82	137	156	167	101	69	
	167	62	162	89	147	60	149	131	49												
T6-I	146	148	137	127	141	129	146	150	166	144	145	142	144	143	128	136	129	54	58	153	
T6-II	151	131	119	58	149	150	132	134													
<i>Syphodus atricauda</i>																					
T4-I	48	73	54	38	49	44	40	64	43	53	68	62	43	48	40	48	35	52	49	42	
	44	55	39	58	130	46	52	139	66	48											
T4-II	138																				
T5-I	132																				
<i>Syngnathus californiensis</i>																					
T2-I	242	231	123																		
T2-II	187	208																			
T6-II	189																				
<i>Umbrina roncador</i>																					
T3-II	118	102	108																		
T6-I	121																				

Appendix H-6. (Cont.).

Species	Sta-Rep	Length (mm)				
<i>Urolophus halleri</i>						
T3-II	DW	205	121	92	102	
	TL	349	214	141	173	
T4-I	DW	210				
	TL	358				
<i>Xystreurus liolepis</i>						
T3-I		246				
T3-II		227				
T4-I		189				
T5-I		188				

*Fish measuring less than 30 mm (not included above):

Species	Station-Replicate												Total
	T1-I	T1-II	T2-I	T2-II	T3-I	T3-II	T4-I	T4-II	T5-I	T5-II	T6-I	T6-II	
<i>Engraulis mordax</i>	-	-	-	-	2	-	-	-	3	15	3	-	23
<i>Genyonemus lineatus</i>	-	-	6	104	16	20	2	10	76	35	20	-	289

Fish diseases, abnormalities, and parasitism:

Species	Sta-Rep	Length (mm)	Note
<i>Myliobatis californica</i>	T2-II	DW 480	Spine missing
<i>Paralichthys californicus</i>	T3-I	373	Damaged caudal fin
<i>Xystreurus liolepis</i>	T5-I	188	Damaged caudal fin

TL = Total Length, DW = Disc Width

Appendix H-7. Lengths of fish species in trawl replicates. Haynes and AES Alamitos L.L.C. generating stations NPDES, summer 2001.

Species	Sta-Rep	Length (mm)											
<i>Citharichthys stigmaeus</i>													
T3-I	83	94											
T4-I	77	84	36										
T4-II	101												
T5-I	78	45											
T6-I	84	81	45										
<i>Cymatogaster aggregata</i>													
T4-I	84												
T4-II	87	115	86	75	68	82	81	82					
<i>Engraulis mordax*</i>													
T4-I	64	57	56	59	58	57	54						
<i>Genyonemus lineatus*</i>													
T1-I	149	159											
T3-II	162												
T4-I	187	212	187	183	165	204							
T4-II	183	181	187	193	188	162	168	182	197	226	182	207	181
	225										158	182	191
		156									185	174	190
											162		
<i>Hypsopsetta guttulata</i>													
T3-I	193												
<i>Leptocottus armatus</i>													
T3-II	145												
<i>Myliobatis californica</i>													
T4-II	TL	691	F										
	DW	484											
<i>Paralabrax nebulifer</i>													
T2-I	233												
T6-I	161												
<i>Paralichthys californicus</i>													
T1-I	191												
T1-II	134												
T2-I	364	189											
T2-II	365	176	164										
T3-I	292												
T4-II	287												
T5-I	527	166											
T5-II	263												
T6-I	293	293	279										
<i>Peprilus simillimus</i>													
T4-I	115	123	118	95	111	103	109	120	104	121	111	108	
<i>Phanerodon furcatus</i>													
T4-II	188	182	157	186	147	190	144						
T5-I	200	161											
<i>Pleuronichthys ritteri</i>													
T3-I	171												
T3-II	172												
T4-I	152												
<i>Porichthys notatus</i>													
T4-II	154	157											
<i>Scorpaena guttata</i>													
T4-II	229												
<i>Seriphus politus*</i>													
T4-I	153												
<i>Sympodus atricauda</i>													
T4-I	86												
T4-II	98	105	82	86	178								

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Appendix H-7. (Cont.).

Species	Sta-Rep	Length (mm)									
<i>Synodus lucioceps</i>											
T2-I	149	162	169								
T3-I	182	202	173	210	166	165	179	185			
T3-II	155	123	196	203	146	131	178	195	130		
T4-II	153	140	159	187							
T5-I	172	172	181								
T5-II	200										
T6-I	173	155									
T6-II	152	155	170	156	143	150	149	147	172	159	

*Fish measuring less than 30 mm (not included above):

Species	Station-Replicate											Total	
	T1-I	T1-II	T2-I	T2-II	T3-I	T3-II	T4-I	T4-II	T5-I	T5-II	T6-I	T6-II	
<i>Engraulis mordax</i>	2	-	-	1	-	2	2	23	-	-	1	-	31
<i>Seriphus politus</i>	165	-	-	-	1	-	-	26	-	-	-	-	192

Fish diseases, abnormalities, and parasitism:

Species	Sta-Rep	Length (mm)	Note
<i>Citharichthys stigmaeus</i>	T5-I	78	<i>Elthusa vulgaris</i>

TL = Total Length, DW = Disc Width

Appendix H-8. Abundance of macroinvertebrate species in trawl replicates. Haynes and AES Alamitos L.L.C. generating stations NPDES, winter 2001.

Species	Station-Replicate												Percent			
	T1-I	T1-II	T2-I	T2-II	T3-I	T3-II	T4-I	T4-II	T5-I	T5-II	T6-I	T6-II	Total	Total	Mean	S.D.
<i>Crangon nigromaculata</i>	15	7	106	115	38	183	128	1	43	10	24	19	689	57.61	57.4	59.8
<i>Pyromia tuberculata</i>	141	85	68	22	5	12	2	1	-	-	-	-	336	28.09	28.0	45.7
<i>Philine auriformis</i>	-	-	-	-	-	49	12	-	-	-	1	-	62	5.18	5.2	14.2
<i>Astropecten armatus</i>	1	1	7	-	3	1	2	2	11	8	9	13	58	4.85	4.8	4.5
<i>Heptacarpus palpator</i>	-	-	-	-	-	-	20	-	-	-	-	-	20	1.67	1.7	5.8
<i>Portunus xantisii</i>	1	-	1	1	-	1	1	-	2	-	5	1	13	1.09	1.1	1.4
<i>Cancer gracilis</i>	-	1	1	-	-	1	-	-	-	-	-	-	3	0.25	0.3	0.5
<i>Nassarius perpinguis</i>	-	-	-	-	-	1	-	-	1	-	1	-	3	0.25	0.3	0.5
<i>Cancer anthonyi</i>	-	-	-	-	-	1	-	-	-	1	-	-	2	0.17	0.2	0.4
<i>Armina californica</i>	-	-	-	-	-	-	-	1	-	-	-	-	1	0.08	0.1	0.3
<i>Chlamydoconcha orcutti</i>	-	-	-	-	-	-	-	-	-	-	1	-	1	0.08	0.1	0.3
<i>Flabellina iodinea</i>	-	-	-	-	-	-	-	-	1	-	-	-	1	0.08	0.1	0.3
<i>Isocheles sp</i>	-	-	-	-	-	-	-	-	-	-	-	-	1	0.08	0.1	0.3
<i>Limaria hemphilli</i>	-	-	-	-	-	-	-	-	-	-	1	-	1	0.08	0.1	0.3
<i>Neverita recluseiana</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.08	0.1	0.3
<i>Pachycheles pubescens</i>	-	-	-	-	-	-	-	-	-	-	1	-	1	0.08	0.1	0.3
<i>Panulirus interruptus</i>	1	-	-	-	-	-	-	-	-	-	-	-	1	0.08	0.1	0.3
<i>Peneaeus californiensis</i>	-	-	-	-	-	-	-	1	-	-	-	-	1	0.08	0.1	0.3
<i>Pisaster brevispinus</i>	-	-	-	-	-	-	1	-	-	-	-	-	1	0.08	0.1	0.3
Station totals																
Number of individuals	253		321		246		222		77		77		1196	199.3	100.3	
Number of species	6		5		7		10		6		9		19	7.2	1.9	
Diversity (H')	1.07		1.38		0.90		1.32		1.37		1.83		1.19	1.31	0.32	

Appendix H-9. Abundance of macroinvertebrate species in trawl replicates. Haynes and AES Alamitos L.L.C. generating stations NPDES, summer 2001.

Species	Station-Replicate												Percent			
	T1-I	T1-II	T2-I	T2-II	T3-I	T3-II	T4-I	T4-II	T5-I	T5-II	T6-I	T6-II	Total	Total	Mean	S.D.
<i>Pyromia tuberculata</i>	6	22	9	13	19	29	10	2	-	-	-	-	110	71.90	9.2	9.9
<i>Astropecten armatus</i>	2	2	5	1	1	4	-	1	1	-	-	2	19	12.42	1.6	1.6
<i>Crangon nigromaculata</i>	-	1	-	2	-	3	-	5	-	2	-	-	13	8.50	1.1	1.6
<i>Loxorhynchus crispatus</i>	-	-	-	-	-	-	-	-	-	-	3	-	3	1.96	0.3	0.9
<i>Isocheles pilosus</i>	-	-	-	-	-	-	-	-	-	1	1	-	2	1.31	0.2	0.4
<i>Renilla kollikeri</i>	1	-	-	-	1	-	-	-	-	-	-	-	2	1.31	0.2	0.4
<i>Lytechinus pictus</i>	-	-	-	-	-	-	-	-	1	-	-	-	1	0.65	0.1	0.3
<i>Nassarius perpinguis</i>	-	-	-	-	-	1	-	-	-	-	-	-	1	0.65	0.1	0.3
<i>Ophiothrix spiculata</i>	-	-	-	-	-	-	-	-	-	-	1	-	1	0.65	0.1	0.3
<i>Randalia ornata</i>	-	-	-	-	-	-	-	-	-	1	-	-	1	0.65	0.1	0.3
Station totals																
Number of individuals	34		30		58		18		6		7		153	25.5	19.6	
Number of species	4		3		5		3		5		4		10	4.0	0.9	
Diversity (H')	1.13		1.32		1.26		1.09		1.56		1.28		1.03			

Appendix H-10. Biomass (kg) of macroinvertebrate species in trawl replicates Haynes and AES Alamitos L.L.C. generating stations NPDES, winter 2001.

Species	Station-Replicate												Percent			
	T1-I	T1-II	T2-I	T2-II	T3-I	T3-II	T4-I	T4-II	T5-I	T5-II	T6-I	T6-II	Total	Total	Mean	S.D.
<i>Pisaster brevispinus</i>	-	-	-	-	-	-	2.950	-	-	-	-	-	2.950	52.80	0.25	0.85
<i>Astropecten armatus</i>	0.054	0.045	0.097	-	0.031	0.009	0.038	0.090	0.179	0.165	0.135	0.280	1.123	20.10	0.09	0.08
<i>Crangon nigromaculata</i>	0.011	0.004	0.115	0.092	0.043	0.222	0.087	0.002	0.039	0.020	0.070	0.008	0.713	12.76	0.06	0.06
<i>Penulirrus interruptus</i>	0.570	-	-	-	-	-	-	-	-	-	-	-	0.570	10.20	0.05	0.16
<i>Pyromaia tuberculata</i>	0.052	0.010	0.031	0.013	0.007	0.013	0.002	0.001	-	-	-	-	0.129	2.31	0.01	0.02
<i>Penaeus californiensis</i>	-	-	-	-	-	-	-	0.045	-	-	-	-	0.045	0.81	0.00	0.01
<i>Portunus xantisii</i>	0.001	-	0.001	0.001	-	0.003	0.006	-	0.003	-	0.008	0.002	0.025	0.45	0.00	0.00
<i>Philine auriformis</i>	-	-	-	-	-	-	0.002	0.002	-	-	0.002	-	0.006	0.11	0.00	0.00
<i>Limaria hemphilli</i>	-	-	-	-	-	-	-	-	0.004	-	-	0.004	0.07	0.00	0.00	0.00
<i>Nassarius perpinguis</i>	-	-	-	-	-	0.001	-	-	0.001	-	0.002	-	0.004	0.07	0.00	0.00
<i>Cancer gracilis</i>	-	0.001	0.001	-	-	0.001	-	-	-	-	-	-	0.003	0.05	0.00	0.00
<i>Isocheles</i> sp	-	-	-	-	-	-	-	-	-	-	-	0.003	0.003	0.05	0.00	0.00
<i>Cancer anthonyi</i>	-	-	-	-	-	0.001	-	-	-	0.001	-	-	0.002	0.04	0.00	0.00
<i>Chlamydoconcha orcutti</i>	-	-	-	-	-	-	-	-	-	-	0.002	-	0.002	0.04	0.00	0.00
<i>Flabellina iodirea</i>	-	-	-	-	-	-	-	0.002	-	-	-	-	0.002	0.04	0.00	0.00
<i>Heptacarpus palpator</i>	-	-	-	-	-	-	0.002	-	-	-	-	-	0.002	0.04	0.00	0.00
<i>Neverita reclusiana</i>	-	-	-	-	-	-	0.002	-	-	-	-	-	0.002	0.04	0.00	0.00
<i>Armina californica</i>	-	-	-	-	-	-	-	0.001	-	-	-	-	0.001	0.02	0.00	0.00
<i>Pachycheles pubescens</i>	-	-	-	-	-	-	-	-	-	-	0.001	-	0.001	0.02	0.00	0.00
Station totals																
Biomass	0.748	0.351	0.331	3.230	0.410	0.517	5.587	0.93	1.14							

Note: 0.00=<0.005

Appendix H-11. Biomass (kg) of macroinvertebrate species in trawl replicates Haynes and AES Alamitos L.L.C. generating stations NPDES, summer 2001.

Species	Station-Replicate												Percent			
	T1-I	T1-II	T2-I	T2-II	T3-I	T3-II	T4-I	T4-II	T5-I	T5-II	T6-I	T6-II	Total	Total	Mean	S.D.
<i>Loxorhynchus crispatus</i>	-	-	-	-	-	-	-	-	-	-	0.910	-	0.910	60.11	0.08	0.26
<i>Astropecten armatus</i>	0.040	0.024	0.098	0.018	0.021	0.105	-	0.010	0.021	-	-	0.037	0.374	24.70	0.03	0.04
<i>Pyromaia tuberculata</i>	0.010	0.028	0.007	0.019	0.025	0.040	0.003	0.005	-	-	-	-	0.137	9.05	0.01	0.01
<i>Lytechinus pictus</i>	-	-	-	-	-	-	-	-	0.029	-	-	-	0.029	1.92	0.00	0.01
<i>Renilla kollikeri</i>	0.008	-	-	-	0.016	-	-	-	-	-	-	-	0.024	1.59	0.00	0.00
<i>Isocheles pilosus</i>	-	-	-	-	-	-	-	-	0.012	0.010	-	-	0.022	1.45	0.00	0.00
<i>Crangon nigromaculata</i>	-	0.001	-	0.004	-	0.001	-	0.005	-	0.001	-	-	0.012	0.79	0.00	0.00
<i>Randalia ornata</i>	-	-	-	-	-	-	-	-	0.005	-	-	-	0.005	0.33	0.00	0.00
<i>Ophiothrix spiculata</i>	-	-	-	-	-	-	-	-	-	-	0.001	-	0.001	0.07	0.00	0.00
<i>Nassarius perpinguis</i>	-	-	-	-	-	0.001	-	-	-	-	-	-	0.000	0.00	0.00	0.00
Station totals																
Biomass	0.111	0.146	0.208	0.023	0.068	0.958	1.514	0.25	0.35							

Note: 0.00=<0.005, 0.000 = <0.0005

Appendix H-12. Total count of all demersal fish species taken by otter trawl, 1972-2001. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Species	Year														PERCENT	
	1972*	1978	1980	1986	1988	1990	1991	1992	1993	1994	1997	1999	2000	2001	TOTAL	TOTAL
<i>Engraulis mordax</i>	1659	166	2486	52	135	2951	34952	405	3453	14658	3108	1006	4001	23	69055	52.22
<i>Gennonemus lineatus</i>	1297	9296	3731	3319	1844	669	980	1775	2335	2635	409	1625	689	399	31003	23.45
<i>Seriphus politus</i>	2081	599	1615	1761	276	2891	213	962	1439	6097	14	426	68	103	18545	14.02
<i>Syphurus atricauda</i>	222	822	21	266	259	33	76	105	297	100	14	54	10	38	2317	1.75
<i>Phanerodon furcatus</i>	1536	225	256	5	9	3	8	9	16	32	55	13	14	15	2196	1.66
<i>Citharichthys stigmaeus</i>	254	38	17	38	369	192	154	98	114	58	15	108	72	114	1641	1.24
<i>Cymatogaster aggregata</i>	1173	37	21	1	4	1	-	2	1	19	14	22	1	10	1306	0.99
<i>Paralichthys californicus</i>	110	31	39	76	101	90	92	64	62	47	92	92	97	39	1032	0.78
<i>Pleuronichthys ritteri</i>	-	1	4	62	95	73	83	68	63	46	26	48	24	27	620	0.47
<i>Hyperoplus argenteum</i>	446	8	36	-	5	1	2	9	13	1	-	-	1	522	0.39	
<i>Anchoa compressa</i>	63	98	66	74	-	23	3	21	80	46	-	12	1	1	488	0.37
<i>Citharichthys sordidus</i>	393	-	-	-	-	-	-	-	-	-	-	-	-	-	393	0.30
<i>Pleuronichthys verticalis</i>	145	27	8	34	49	20	4	25	9	4	6	22	8	1	362	0.27
<i>Synodus lucioceps</i>	-	29	-	4	78	28	14	35	3	2	1	57	33	40	324	0.25
<i>Anchoa delicatissima</i>	-	-	154	79	3	28	-	-	46	2	-	3	-	-	315	0.24
<i>Xystreurus liolepis</i>	-	2	3	21	36	19	53	18	24	19	10	34	10	4	253	0.19
<i>Ophidion scrippsae</i>	1	29	-	133	-	1	-	25	18	5	-	-	-	-	212	0.16
<i>Paralabrax nebulifer</i>	3	1	2	12	12	13	7	10	11	8	10	84	24	5	202	0.15
<i>Menticirrhus undulatus</i>	26	9	32	51	3	9	2	1	10	3	-	3	7	4	160	0.12
<i>Hypsopsetta guttulata</i>	15	8	10	11	14	16	8	17	17	9	3	11	5	5	149	0.11
<i>Sardinops sagax</i>	-	-	-	1	-	4	10	13	5	7	50	16	-	-	106	0.08
<i>Myloplus californica</i>	11	2	18	8	3	1	3	3	15	12	-	15	3	2	96	0.07
<i>Peripilus simillimus</i>	23	18	1	7	13	-	1	-	-	11	8	-	-	12	94	0.07
<i>Urolophus halleni</i>	2	-	2	11	13	20	9	5	12	3	-	1	-	5	83	0.06
<i>Syngnathus spp**</i>	2	23	9	3	4	6	8	8	2	-	-	6	2	6	79	0.06
<i>Rhinobatos productus</i>	44	1	5	3	1	2	13	3	-	1	1	4	-	-	78	0.06
<i>Porichthys myriaster</i>	8	3	-	10	17	3	6	1	7	-	2	12	5	-	74	0.06
<i>Amphistius argenteus</i>	46	9	10	-	-	-	-	-	-	-	-	-	-	-	65	0.05
<i>Lepidogobius lepidus</i>	-	-	-	1	2	-	-	1	-	20	-	21	14	2	61	0.05
<i>Acanthogobius flavimanus</i>	-	-	-	-	-	-	58	-	1	-	-	1	-	-	60	0.05
<i>Embiotoca jacksoni</i>	22	18	3	1	-	-	1	-	2	3	-	-	-	2	52	0.04
<i>Platyrrhinoidis triseriata</i>	2	2	-	7	5	3	3	8	3	5	2	5	-	-	45	0.03
<i>Leptocottus armatus</i>	12	1	1	3	14	1	-	1	4	1	-	3	-	1	42	0.03
<i>Tilapia mossambica</i>	-	31	-	1	-	-	-	-	-	-	-	-	-	-	32	0.02
<i>Umbrina roncador</i>	-	-	2	-	20	-	-	-	-	4	-	-	-	4	30	0.02
<i>Atherinopsis californiensis</i>	-	-	7	-	-	-	-	3	1	3	10	5	-	-	29	0.02
<i>Porichthys notatus</i>	7	-	-	7	-	-	-	-	-	4	-	-	-	2	20	0.02
<i>Damalichthys vacca</i>	-	-	1	5	-	1	-	-	1	1	-	-	-	2	11	0.01
<i>Scorpaena guttata</i>	-	-	-	-	1	1	-	-	-	1	3	2	-	1	9	0.01
<i>Atractoscion nobilis</i>	-	-	2	-	3	-	-	1	-	2	-	-	-	-	8	0.01
<i>Xenistius californiensis</i>	-	-	-	-	-	-	-	1	2	4	-	-	-	-	7	0.01
<i>Heterostichus rostratus</i>	-	-	-	-	1	-	1	1	-	2	-	-	-	1	6	0.00
<i>Parophyres vetulus</i>	2	1	-	2	1	-	-	-	-	-	-	-	-	-	6	0.00
<i>Sebastes dallii</i>	-	6	-	-	-	-	-	-	-	-	-	-	-	-	6	0.00
<i>Pleuronichthys decurrens</i>	5	-	-	-	-	-	-	-	-	-	-	-	-	-	5	0.00
<i>Cheilotrema satumum</i>	-	-	-	-	-	1	2	-	-	-	-	1	-	-	4	0.00
<i>Chilara taylori</i>	1	3	-	-	-	-	-	-	-	-	-	-	-	-	4	0.00
<i>Raja binoculata</i>	-	-	-	-	-	-	-	1	-	-	-	1	-	3	0.00	
<i>Sebastes miniatus</i>	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3	0.00
<i>Anisotremus davidsoni</i>	1	-	-	-	-	-	-	-	1	-	-	-	-	-	2	0.00
<i>Atherinops affinis</i>	-	1	-	-	-	-	-	-	-	-	-	1	-	-	2	0.00
Bothidae, unid.	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.00
<i>Chromis punctipinnis</i>	-	-	-	-	-	-	-	1	-	-	1	-	-	-	2	0.00
<i>Citharichthys xanthostigma</i>	-	1	-	-	-	-	-	1	-	-	-	-	-	-	2	0.00
<i>Torpedo californica</i>	-	-	-	1	-	-	-	1	-	-	-	-	-	-	2	0.00
<i>Clevelandia ios</i>	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	0.00
<i>Hemilepidotus hemilepidotus</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00
<i>Heterodontus francisci</i>	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00
<i>Hippoglossina stoma</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00
<i>Mustelus henlei</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00
<i>Raja inornata</i>	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00
<i>Rhacochilus toxotes</i>	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00
<i>Scomber japonicus</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00
<i>Squalus acanthias</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00
<i>Trachurus symmetricus</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00
Total individuals	9618	11547	8562	6070	3386	7108	36765	3693	8065	23889	3856	3718	5092	866	132235	
Total species	36	34	29	34	31	30	28	33	34	38	24	34	23	27	65	

Note: 0.00 = < 0.005

*From three trawl surveys in 1971 and 1972.

** "Syngnathus sp" may include *S. exilis*, *S. californiensis*, and *S. griseolineatus*.

Appendix H-13. Numerical ranking of all demersal fish species taken by otter trawl, 1972-2001. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Species	Year														Average where occurred
	1972*	1978	1980	1986	1988	1990	1991	1992	1993	1994	1997	1999	2000	2001	
<i>Genyonemus lineatus</i>	4	1	1	1	1	3	2	1	2	3	2	1	2	1	1.8
<i>Engraulis mordax</i>	2	5	2	9	5	1	1	3	1	1	1	2	1	7	2.9
<i>Seriphus politus</i>	1	3	3	2	3	2	3	2	3	2	8	3	5	3	3.1
<i>Citharichthys stigmaeus</i>	8	7	13	11	2	4	4	5	5	5	7	4	4	2	5.8
<i>Paralichthys californicus</i>	11	9	7	6	6	5	5	7	8	6	3	5	3	5	6.1
<i>Syphurus atrocauda</i>	9	2	10	3	4	7	7	4	4	4	8	8	11	5	6.1
<i>Citharichthys sordidus</i>	7	-	-	-	-	-	-	-	-	-	-	-	-	-	7.0
<i>Pleuronichthys ritteri</i>	-	27	20	8	7	6	6	6	7	7	6	9	7	6	9.4
<i>Phanerodon furcatus</i>	3	4	4	22	18	20	14	16	13	9	4	16	9	8	11.4
<i>Anchoa compressa</i>	12	6	6	7	-	10	20	11	6	7	-	17	20	16	11.5
<i>Xystreurus liolepis</i>	-	24	21	13	10	13	9	12	10	11	11	10	11	14	13.0
<i>Synodus lucioceps</i>	-	11	-	24	8	8	10	8	23	29	20	7	6	4	13.2
<i>Pleuronichthys verticalis</i>	10	13	17	12	9	11	19	9	18	21	15	11	13	16	13.9
<i>Anchoa delicatissima</i>	-	-	5	5	22	8	-	-	9	29	-	24	-	-	14.6
<i>Amphistius argenteus</i>	13	17	14	-	-	-	-	-	-	-	-	-	-	-	14.7
<i>Hypsopsetta guttulata</i>	18	17	14	15	13	14	14	13	12	16	16	19	15	12	14.9
<i>Ophidion scriptum</i>	30	11	-	4	-	24	-	9	11	19	-	-	-	-	15.4
<i>Paralabrax nebulifer</i>	24	27	23	14	17	15	17	15	16	17	11	6	7	13	15.9
<i>Cymatogaster aggregata</i>	5	8	10	29	20	24	-	23	28	11	8	11	20	10	15.9
<i>Hyperprosopon argenteum</i>	6	17	8	-	-	18	25	23	18	13	20	-	-	16	16.4
<i>Sardinops sagax</i>	-	-	-	29	-	19	12	14	21	18	5	14	-	-	16.5
<i>Pepulus similimus</i>	16	15	27	19	15	-	25	-	-	15	14	-	-	9	17.2
<i>Umbrina roncador</i>	-	-	23	-	11	-	-	-	-	21	-	-	-	14	17.3
<i>Menticirrhus undulatus</i>	15	17	9	10	22	16	23	25	17	25	-	24	14	14	17.8
<i>Myliobatis californica</i>	20	24	12	18	22	24	20	20	14	14	-	15	17	15	18.1
<i>Lepidogobius lepidus</i>	-	-	-	29	26	-	-	25	-	10	-	13	9	15	18.1
<i>Urolophus halleri</i>	25	-	23	15	15	11	13	19	15	25	-	29	-	13	18.5
<i>Syngnathus spp**</i>	25	14	16	25	20	17	14	17	25	-	-	20	18	11	18.5
<i>Porichthys myriaster</i>	21	22	-	17	12	20	18	25	20	-	18	17	15	-	18.6
<i>Tilapia mossambica</i>	-	9	-	29	-	-	-	-	-	-	-	-	-	-	19.0
<i>Porichthys notatus</i>	22	-	-	19	-	-	-	-	-	21	-	-	-	15	19.3
<i>Scomber japonicus</i>	-	-	-	-	-	-	-	-	-	-	20	-	-	-	20.0
<i>Platyrrhinoidis triseriata</i>	25	24	-	19	19	20	20	17	23	19	18	21	-	-	20.5
<i>Atherinopsis californiensis</i>	-	-	18	-	-	-	-	20	28	25	11	21	-	-	20.5
<i>Sebastodes dallii</i>	-	21	-	-	-	-	-	-	-	-	-	-	-	-	21.0
<i>Embiotoca jacksoni</i>	17	15	21	29	-	-	25	-	25	25	-	-	-	15	21.5
<i>Acanthogobius flavimanus</i>	-	-	-	-	-	-	8	-	28	-	-	29	-	-	21.7
<i>Rhinobatos productus</i>	14	27	19	25	27	23	11	20	-	33	20	23	-	-	22.0
<i>Chromis punctipinnis</i>	-	-	-	-	-	-	25	-	-	20	-	-	-	-	22.5
<i>Pleuronichthys decurrens</i>	23	-	-	-	-	-	-	-	-	-	-	-	-	-	23.0
<i>Leptocottus armatus</i>	19	27	27	25	13	24	-	25	22	33	-	24	-	16	23.2
<i>Xenistius californiensis</i>	-	-	-	-	-	-	25	25	21	-	-	-	-	-	23.7
<i>Scorpaena guttata</i>	-	-	-	-	27	24	-	-	33	16	28	-	16	-	24.0
<i>Sebastes miniatus</i>	-	-	-	-	-	-	-	-	-	-	24	-	-	-	24.0
<i>Atractoscion nobilis</i>	-	-	23	-	22	-	-	25	-	29	-	-	-	-	24.8
Bothidae, unid.	25	-	-	-	-	-	-	-	-	-	-	-	-	-	25.0
<i>Heterostichus rostratus</i>	-	-	-	-	27	-	25	25	-	29	-	-	20	-	25.2
<i>Cheilotrema saturnum</i>	-	-	-	-	-	24	23	-	-	-	-	29	-	-	25.3
<i>Damalichthys vacca</i>	-	-	27	22	-	24	-	-	28	33	-	-	18	-	25.3
<i>Raja binoculata</i>	-	-	-	-	-	-	-	-	28	-	-	29	20	-	25.7
<i>Chilara taylori</i>	30	22	-	-	-	-	-	-	-	-	-	-	-	-	26.0
<i>Citharichthys xanthostigma</i>	-	27	-	-	-	-	-	25	-	-	-	-	-	-	26.0
<i>Parophryes velutinus</i>	25	27	-	28	27	-	-	-	-	-	-	-	-	-	26.8
<i>Raja inornata</i>	-	-	-	-	27	-	-	-	-	-	-	-	-	-	27.0
<i>Rhacochilus toxotes</i>	-	27	-	-	-	-	-	-	-	-	-	-	-	-	27.0
<i>Atherinops affinis</i>	-	27	-	-	-	-	-	-	-	-	-	29	-	-	28.0
<i>Clevelandia ios</i>	-	-	-	-	-	-	-	-	28	-	-	-	-	-	28.0
<i>Torpedo californica</i>	-	-	-	29	-	-	-	-	28	-	-	-	-	-	28.5
<i>Heterodontus francisci</i>	-	-	-	-	-	-	-	-	-	-	-	29	-	-	29.0
<i>Hemilepidotus hemilepidotus</i>	30	-	-	-	-	-	-	-	-	-	-	-	-	-	30.0
<i>Hippoglossina stromata</i>	30	-	-	-	-	-	-	-	-	-	-	-	-	-	30.0
<i>Mustelus henlei</i>	30	-	-	-	-	-	-	-	-	-	-	-	-	-	30.0
<i>Squalus acanthias</i>	30	-	-	-	-	-	-	-	-	-	-	-	-	-	30.0
<i>Anisotremus davidsoni</i>	30	-	-	-	-	-	-	-	-	33	-	-	-	-	31.5
<i>Trachurus symmetricus</i>	-	-	-	-	-	-	-	-	-	33	-	-	-	-	33.0
Total individuals	9618	11547	8562	6070	3386	7108	36765	3692	8065	23889	3856	3719	5092	866	
Total species	36	34	29	34	31	30	28	33	34	38	24	34	23	27	

*From three trawl surveys in 1971 and 1972.

** "Syngnathus" sp may include *S. exilis*, *S. californiensis*, and *S. griseolineatus*

APPENDIX I

Fish and macroinvertebrate heat treatment data

Appendix I-1. Master species list of fish and macroinvertebrate species taken during heat treatments at both Haynes and AES Alamitos L.L.C. generating stations. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001

PHYLUM Class Family Species	Common Name	PHYLUM Class Family Species	Common Name
MOLLUSCA		ECHINODERMATA	
Bivalvia		Echinoidea	
Pectinidae		Strongylocentrotidae	
<i>Argopecten ventricosus</i>	Pacific calico scallop	<i>Strongylocentrotus purpuratus</i>	purple sea urchin
Veneridae		Holothuroidea	
<i>Chione californiensis</i>	California venus	Stichopodidae	
Cephalopoda		<i>Parastichopus parvimensis</i>	warty sea cucumber
Loliginidae		CHORDATA	
<i>Loligo opalescens</i>	California market squid	Elasmobranchiomorphi (=Chondrichthyes, Elasmobranchii)	
Octopodidae		Dasyatidae	
<i>Octopus bimaculoides</i>	California two-spot octopus	<i>Urolophus halleri</i>	round stingray
Gastropoda		Myliobatidae	
Aglajidae		<i>Myliobatis californica</i>	bat ray
<i>Navanax inermis</i>	California aglaja (=striped sea hare)	Osteichthyes (=Actinopterygii)	
Calyptaeidae		Clupeidae	
<i>Crucibulum spinosum</i>	spiny cup-and-saucer	<i>Sardinops sagax</i>	Pacific sardine
<i>Crepidapetella dorsata</i>	Pacific half-slippersnail	Engraulidae	
<i>Crepidula onyx</i>	onyx slippersnail	<i>Anchoa compressa</i>	deepbody anchovy
Fissurellidae		<i>Anchoa delicatissima</i>	slough anchovy
<i>Fissurellidae bimaculata</i>	two-spot keyhole limpet	<i>Engraulis mordax</i>	northern anchovy
Trochidae		Embiotocidae	
<i>Calliostoma</i> sp	topsnail	<i>Cymatogaster aggregata</i>	shiner perch
Haminaeidae		<i>Phanerodon furcatus</i>	white seaperch
<i>Haminaea virescens</i>	green glassy bubble snail	Batrachoididae	
Nudibranchia		<i>Porichthys myriaster</i>	specklefin midshipman
Discodorididae		<i>Porichthys notatus</i>	plainfin midshipman
<i>Anisodoris nobilis</i>	Pacific sea-lemon	Belonidae	
ARTHROPODA		<i>Strongylura exilis</i>	California needlefish
Malacostraca		Atherinidae	
Penaeidae		<i>Atherinops affinis</i>	topsmelt
<i>Farfantepenaeus californiensis</i>	yellowleg shrimp	<i>Atherinopsis californiensis</i>	jacksmelt
(= <i>Penaeus californiensis</i>)		<i>Leuresthes tenuis</i>	grunion
Majidae		Sciaenidae	
<i>Pyromesia tuberculata</i>	tuberculate pear crab	<i>Cheilotrema setarium</i>	black croaker
<i>Pugettia producta</i>	shield-backed kelp crab	<i>Genyonemus lineatus</i>	white croaker
<i>Taliepus nuttalli</i>	globose kelp crab	<i>Seriphus politus</i>	queenfish
Grapsidae		Syngnathidae	
<i>Hemigrapsus oregonensis</i>	yellow shore crab	<i>Syngnathus leptorhynchus</i>	bay pipefish
<i>Pachygrapsus crassipes</i>	striped shore crab	Clinidae	
Portunidae		<i>Heterostichus rostratus</i>	giant kelpfish
<i>Portunus xantusii</i>	xantus swimming crab	Bothidae (=Paralichthyidae)	
CNIDARIA		<i>Paralichthys californicus</i>	California halibut
Hydrozoa			
Polyorchidae			
<i>Polyorchis pellucens</i>	red jellyfish		

Appendix I-2. Abundance of fish impinged during heat treatments by unit and date at Haynes Generating Station, Haynes and AES Alamitos L. L. C. generating stations NPDES, 2001.

Species	2000												2001											
	U1 10/18	U5 10/20	U3 11/20	U2 12/5	U4 3/22	U5 3/27	U3 3/28	U2 5/15	U6 5/16	U5 6/1	U6 6/12	U5 7/11	U6 7/12	U5 7/13	U2 9/12	U1 9/27	U4 Total	Percent Total						
<i>Seriphus politus</i>	2	2	-	-	-	-	-	-	-	-	-	207	3	1	2	-	217	89.7						
<i>Anchoa compressa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	6	2.5					
<i>Porichthys myriaster</i>	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	1	1	6	2.5					
<i>Syngnathus leptophynchus</i>	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	3	1.2				
<i>Anchoa delicatissima</i>	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	2	0.8				
<i>Leuresthes tenuis</i>	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	2	0.8			
<i>Urophycis halleri</i>	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	2	0.8				
<i>Cymatogaster aggregata</i>	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.4				
<i>Engraulis mordax</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	0.4				
<i>Heterostichus rostratus</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	0.4				
<i>Phanerodon furcatus</i>	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.4				
Number of individuals	3	3	-	1	-	1	-	-	4	3	-	213	3	1	9	1	242							
Number of species	2	2	-	1	-	1	-	-	3	3	-	6	1	1	4	1	11							

Appendix I-3. Biomass (kg) of fish impinged during heat treatments by unit and date at Haynes Generating Station, Haynes and AES Alamitos L. L. C. generating stations NPDES, 2001.

Species	2000												2001											
	U1 10/18	U5 10/20	U3 11/20	U2 12/5	U4 3/22	U5 3/27	U3 3/28	U2 5/15	U6 5/16	U5 6/1	U6 6/12	U5 7/11	U6 7/12	U5 7/13	U2 9/12	U1 9/27	U4 Total	Percent Total						
<i>Porichthys myriaster</i>	-	-	-	-	-	-	-	-	1,233	-	-	0.197	-	-	0.464	0.152	2,046	75.6						
<i>Urophycis halleri</i>	-	-	-	-	-	-	-	-	0.200	-	-	-	-	-	0.218	-	0.418	15.5						
<i>Seriphus politus</i>	0.002	0.006	-	-	-	-	-	-	-	-	-	0.157	0.004	0.002	0.002	-	0.173	6.4						
<i>Anchoa compressa</i>	-	-	-	-	-	0.003	-	-	-	-	-	-	-	-	0.020	-	0.023	0.9						
<i>Cymatogaster aggregata</i>	-	-	-	-	-	-	-	-	-	0.021	-	-	-	-	-	-	-	0.021	0.8					
<i>Leuresthes tenuis</i>	-	0.006	-	-	0.002	-	-	-	-	-	-	0.001	-	-	-	-	-	0.007	0.3					
<i>Anchoa delicatissima</i>	-	-	-	-	-	-	-	-	-	-	-	0.004	-	-	-	-	-	0.006	0.2					
<i>Syngnathus leptophynchus</i>	0.001	-	-	-	-	-	-	-	-	0.003	-	0.001	-	-	-	-	-	0.005	0.2					
<i>Heterostichus rostratus</i>	-	-	-	-	-	-	-	-	-	0.003	-	-	-	-	-	-	-	0.003	0.1					
<i>Phanerodon furcatus</i>	-	-	-	-	-	-	-	-	-	0.002	-	-	-	-	-	-	-	0.002	0.1					
Biomass (kg)	0.003	0.012	-	0.002	-	0.003	-	-	1.435	0.027	-	0.361	0.004	0.002	0.704	0.152	2.705							

Note: 0.0 = <0.05

Appendix I-4. Abundance of fish impinged during heat treatments by unit at AES Alamitos L.L.C. generating station. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Species	U3 & 4	U6	U5	U6	Total	Percent	Cumulative
	4-Mar	20-Jun	31-Aug	1-Sep		Total	Total
<i>Seriphis politus</i>	-	1	46	27	74	55.2	55.2
<i>Heterostichus rostratus</i>	-	-	10	5	15	11.2	66.4
<i>Atherinops affinis</i>	4	-	-	6	10	7.5	73.9
<i>Cymatogaster aggregata</i>	-	2	8	-	10	7.5	81.3
<i>Engraulis mordax</i>	1	-	2	2	5	3.7	85.1
<i>Porichthys notatus</i>	-	-	5	-	5	3.7	88.8
<i>Paralichthys californicus</i>	-	-	2	2	4	3.0	91.8
<i>Atherinopsis californiensis</i>	-	-	2	-	2	1.5	93.3
<i>Genyonemus lineatus</i>	-	1	1	-	2	1.5	94.8
<i>Porichthys myriaster</i>	-	-	-	2	2	1.5	96.3
<i>Anchoa compressa</i>	-	-	-	1	1	0.7	97.0
<i>Cheilotrema saturnum</i>	-	-	1	-	1	0.7	97.8
<i>Myliobatis californica</i>	-	-	-	1	1	0.7	98.5
<i>Sardinops sagax</i>	-	-	-	1	1	0.7	99.3
<i>Strongylura exilis</i>	-	-	1	-	1	0.7	100.0
Number of individuals	5	4	78	47	134		
Number of species	2	3	10	9	15		

Appendix I-5. Biomass (kg) of fish impinged during heat treatments by unit at AES Alamitos L.L.C. generating station. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Species	U3 & 4	U6	U5	U6	Total	Percent	Cumulative
	4-Mar	20-Jun	31-Aug	1-Sep		Total	Total
<i>Porichthys notatus</i>	-	-	1.294	-	1.294	36.5	36.5
<i>Porichthys myriaster</i>	-	-	-	0.660	0.660	18.6	55.2
<i>Seriphis politus</i>	-	0.006	0.257	0.137	0.400	11.3	66.5
<i>Paralichthys californicus</i>	-	-	0.163	0.160	0.323	9.1	75.6
<i>Myliobatis californica</i>	-	-	-	0.224	0.224	6.3	81.9
<i>Heterostichus rostratus</i>	-	-	0.121	0.042	0.163	4.6	86.5
<i>Atherinops affinis</i>	0.106	-	-	0.024	0.130	3.7	90.2
<i>Genyonemus lineatus</i>	-	0.002	0.107	-	0.109	3.1	93.3
<i>Cymatogaster aggregata</i>	-	0.012	0.069	-	0.081	2.3	95.5
<i>Sardinops sagax</i>	-	-	-	0.049	0.049	1.4	96.9
<i>Strongylura exilis</i>	-	-	0.045	-	0.045	1.3	98.2
<i>Engraulis mordax</i>	0.001	-	0.010	0.014	0.025	0.7	98.9
<i>Atherinopsis californiensis</i>	-	-	0.021	-	0.021	0.6	99.5
<i>Anchoa compressa</i>	-	-	-	0.014	0.014	0.4	99.9
<i>Cheilotrema saturnum</i>	-	-	0.004	-	0.004	0.1	100.0
Biomass (kg)	0.107	0.02	2.091	1.324	3.542		

Appendix I-6. Abundance of macroinvertebrates impinged during heat treatments by unit and date at Haynes Generating Station, Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Species	2000												2001												Percent Total
	U1 10/18	U5 10/20	U3 11/20	U2 12/5	U4 3/22	U5 3/27	U3 3/28	U2 5/15	U5 5/16	U6 6/1	U5 6/12	U6 7/11	U5 7/12	U6 7/13	U1 9/12	U4 9/27	Total								
<i>Pyromaria tuberculata</i>	-	-	-	-	-	-	-	-	5	4	16	1	-	4	-	-	-	30	40.5						
<i>Octopus bimaculoides</i>	-	-	-	-	-	-	-	-	1	-	1	7	4	-	-	-	-	13	17.6						
<i>Crucibulum spinosum</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	4	1	-	6	8.1						
<i>Portunus xantusi</i>	-	-	-	-	-	2	-	1	-	1	-	-	-	-	-	4	-	4	5.4						
<i>Strongylocentrotus purpuratus</i>	2	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	4	5.4						
<i>Navanax inermis</i>	1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	3	4.1						
<i>Anisodoris nobilis</i>	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2	2.7						
<i>Crepidula onyx</i>	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	2.7						
<i>Crepidatella dorsata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2.7						
<i>Haminaea virescens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2.7						
<i>Pachygrapsus crassipes</i>	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	2	2.7						
<i>Fissurellidea bimaculata</i>	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1.4						
<i>Loligo opalescens</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	1.4						
<i>Polyorchis penicillata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.4						
<i>Talitrus saltator</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.4						
Number of individuals	4	2	-	-	4	2	-	1	11	6	19	8	6	5	5	1	74								
Number of species	3	2	-	-	3	1	-	1	6	3	3	2	3	2	2	1	15								

Appendix I-7. Biomass (kg) of macroinvertebrates impinged during heat treatments by unit and date at Haynes Generating Station, Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.

Species	2000												2001												Percent Total
	U1 10/18	U5 10/20	U3 11/20	U2 12/5	U4 3/22	U5 3/27	U3 3/28	U2 5/15	U5 5/16	U6 6/1	U5 6/12	U6 7/11	U5 7/12	U6 7/13	U1 9/12	U4 9/27	Total								
<i>Octopus bimaculoides</i>	-	-	-	-	-	0.060	-	0.023	-	0.009	-	0.014	-	-	-	-	-	-	0.770	74.8					
<i>Portunus xantusi</i>	-	-	-	-	-	-	-	-	0.018	-	-	-	-	-	-	0.014	-	-	0.097	9.4					
<i>Strongylocentrotus purpuratus</i>	0.022	-	-	-	-	-	-	-	-	0.002	0.004	0.014	0.001	-	0.030	-	-	-	0.054	5.2					
<i>Navanax inermis</i>	0.001	0.003	-	-	-	-	-	-	-	-	0.018	-	-	-	-	-	-	-	0.034	3.3					
<i>Pyromaria tuberculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.022	2.1					
<i>Loligo opalescens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.018	1.7					
<i>Anisodoris nobilis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.013	1.3					
<i>Crucibulum spinosum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.006	0.6					
<i>Pachygrapsus crassipes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.004	0.001					
<i>Fissurellidea bimaculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	0.3					
<i>Haminaea virescens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	0.3					
<i>Crepidula onyx</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	0.2					
<i>Polyorchis penicillata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	0.2					
<i>Crepidatella dorsata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001	0.1					
<i>Talitrus saltator</i>	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001	0.1					
Biomass (kg)	0.024	0.005	-	-	-	-	-	-	-	0.006	0.060	-	0.023	0.035	0.036	0.038	0.452	0.330	0.002	0.018	0.001	1.030			

**Appendix I-8. Abundance of macroinvertebrates impinged during heat treatments by unit at AES
Alamitos L.L.C. generating station. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.**

Species	U3 & 4	U6	U5	U6	Total	Percent	Cumulative
	4-Mar	20-Jun	31-Aug	1-Sep		Total	Total
<i>Hemigrapsus oregonensis</i>	-	-	120	8	128	52.5	52.5
<i>Pyromia tuberculata</i>	-	25	15	60	100	41.0	93.4
<i>Octopus bimaculoides</i>	-	-	2	4	6	2.5	95.9
<i>Argopecten circularis</i>	-	-	-	4	4	1.6	97.5
<i>Pugettia producta</i>	-	-	1	1	2	0.8	98.4
<i>Chione californiensis</i>	1	-	-	-	1	0.4	98.8
<i>Farfantepenaeus californiensis</i>	-	1	-	-	1	0.4	99.2
<i>Navanax inermis</i>	-	-	1	-	1	0.4	99.6
<i>Parastichopus parvimensis</i>	-	-	-	1	1	0.4	100.0
Number of individuals	1	26	139	78	244		
Number of species	1	2	5	6	9		

**Appendix I-9. Biomass (kg) of macroinvertebrates impinged during heat treatments by unit at AES
Alamitos L.L.C. generating station. Haynes and AES Alamitos L.L.C. generating stations NPDES, 2001.**

Species	U3 & 4	U6	U5	U6	Total	Percent	Cumulative
	4-Mar	20-Jun	31-Aug	1-Sep		Total	Total
<i>Octopus bimaculoides</i>	-	-	0.583	0.687	1.270	70.1	70.1
<i>Hemigrapsus oregonensis</i>	-	-	0.175	0.008	0.183	10.1	80.2
<i>Pyromia tuberculata</i>	-	0.025	0.035	0.075	0.135	7.5	87.7
<i>Farfantepenaeus californiensis</i>	-	0.110	-	-	0.110	6.1	93.8
<i>Pugettia producta</i>	-	-	0.048	0.001	0.049	2.7	96.5
<i>Parastichopus parvimensis</i>	-	-	-	0.031	0.031	1.7	98.2
<i>Argopecten circularis</i>	-	-	-	0.018	0.018	1.0	99.2
<i>Chione californiensis</i>	0.008	-	-	-	0.008	0.4	99.6
<i>Navanax inermis</i>	-	-	0.007	-	0.007	0.4	100.0
Biomass (kg)	0.008	0.135	0.848	0.820	1.811		